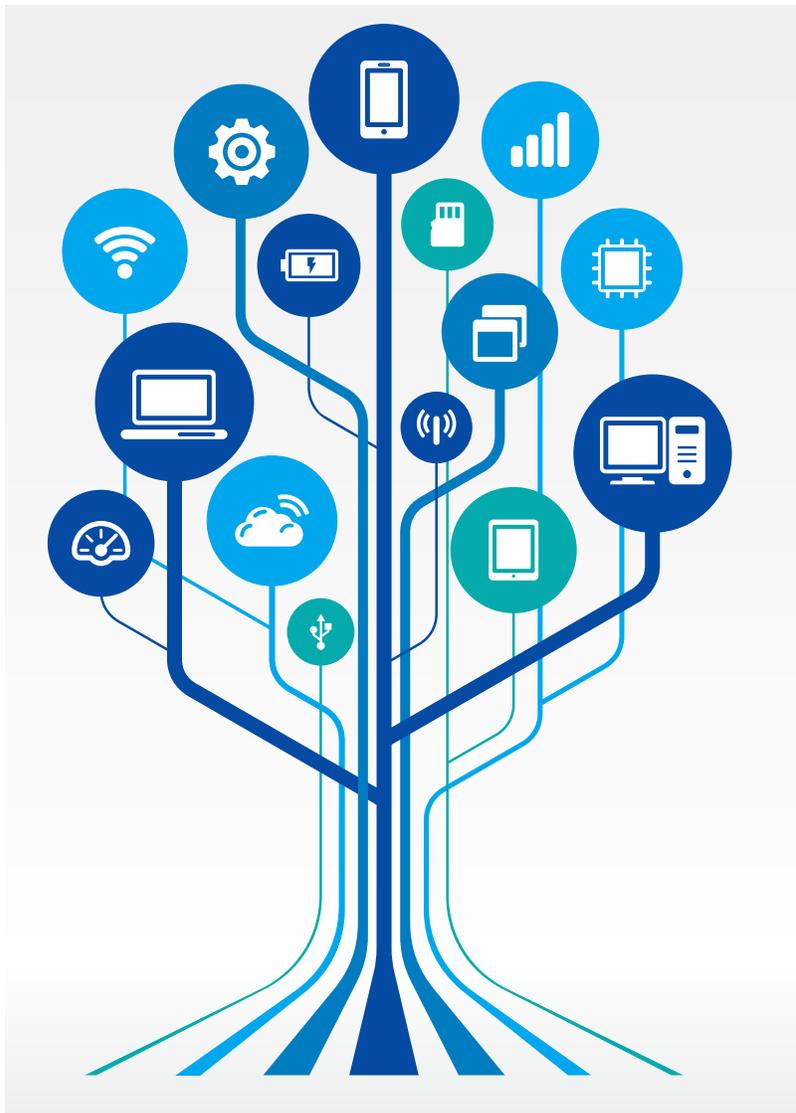




Artificial Intelligence: A Roadmap for California

Report #245, November 2018



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The Little Hoover Commission, formally known as the Milton Marks “Little Hoover” Commission on California State Government Organization and Economy, is an independent state oversight agency created in 1962. By statute, the Commission is bipartisan and composed of nine public members, two senators and two assemblymembers.

In creating the Commission, the Legislature declared its purpose:

[T]o secure assistance for the Governor and itself in promoting economy, efficiency and improved services in the transaction of the public business in the various departments, agencies and instrumentalities of the executive branch of the state government, and in making the operation of all state departments, agencies and instrumentalities, and all expenditures of public funds, more directly responsive to the wishes of the people as expressed by their elected representatives. . .

The Commission fulfills this charge by holding public hearings, consulting with experts and listening to stakeholders. During the course of its studies, the Commission may create subcommittees and conduct site visits.

The findings and recommendations of the Commission are submitted to the Governor and the Legislature for their consideration. Recommendations often take the form of legislation, which the Commission supports through the legislative process.

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Letter From The Chair

November 27, 2018



The Honorable Toni Atkins
President Pro Tempore of the Senate
and Members of the Senate

The Honorable Patricia Bates
Senate Minority Leader

The Honorable Anthony Rendon
Speaker of the Assembly
and Members of the Assembly

The Honorable Marie Waldron
Assembly Minority Leader

Artificial Intelligence: A Roadmap for California is not merely a Commission report—it is a call for action. Other states, cities and countries are surging forward with strategic plans to harness the power of artificial intelligence in ways that will improve their economy, public health and safety, jobs and environment. The race to develop and use AI for good is more akin to a marathon than a sprint. It is fast paced and highly competitive, and one that California should be leading but is not.

Our state owns a lion's share of the world's economy and is home to Silicon Valley. But California state government has yet to accept the AI challenge and truly begin the race. While some departments are collaborating with the private sector and academia to develop and use new technologies, the overwhelming majority are not preparing or strategizing for an AI world.

Imagine using AI applications to predict where fires may occur, detect early-stage wildfires, or guide firefighters where best to fight a fire and save lives. Conceive of an environment where AI could promote biodiversity and water conservation, and protect endangered species. See educators using AI to improve student learning and increase graduation rates. Envision better detection of diseases, including cancer, and more finely-tuned effective treatments. Certainly, such visions must be tempered with appropriate privacy protections and robust laws aimed at preventing the misuse of data. In addition, this encouraging future, which is presently knocking at our door, will require not just foresight but insight, not just political will but political action, and not just one mind but a collaboration of minds in government, academia, and private industry.

Without question 2019 will test the new administration and Legislature with serious challenges from wildfires to homelessness and skyrocketing health care costs. The justifiable cries to correct and solve these momentous problems will compete with the pressing need for AI policymaking. But the Commission's study has found that lawmakers must not let this happen. Lawmakers must act with due diligence and speed in 2019 to enact AI policies that will lead California into a future where AI is developed and used for economic, social and environmental good. Challenges abound in this effort but so do vast opportunities.

Artificial Intelligence: A Roadmap for California provides the new Governor and Legislature with an AI policymaking agenda that revolves around public engagement, building a human infrastructure, attacking pressing social needs, and protecting core values—autonomy, responsibility, privacy, transparency and accountability. In addition, the report offers lawmakers a high level plan that defines strategic AI

objectives and major steps to achieve those objectives. The recommendations are wide ranging and cover:

- State government infrastructure and planning;
- Education and training;
- Collection of data;
- Creation of an AI commission;
- Incentives for AI investment, research and development;
- Improving Employment Development Department (EDD) surveys; and
- Apprenticeships for employees whose jobs and/or classifications may be displaced or transformed by artificial intelligence.

The supporting materials take a deeper dive into the basis and reasons for the Commission's recommendations. There is also a listing of the top AI reports, experts, groups and books.

The Commission's report thus provides a visionary, yet practical, roadmap for California's ethical development and use of artificial intelligence. Surely, as Peter F. Drucker once commented, "[t]he best way to predict the future is to create it." The urgency with which our policymakers must act now cannot be overstated, since the race for AI superiority is already well under way.

Please know the Commission stands ready to provide any further assistance the new Governor or Legislature may request on this topic.



Pedro Nava
Chair, Little Hoover Commission

Contents

Commission Report

Introduction.....	6
What is AI and What Opportunities Does it Offer?.....	7
How Governments are Preparing for AI.....	10
Agenda for Change.....	15

Supporting Materials and Resources

Overview of the Commission's Study.....	21
Sectors Impacted by AI.....	22
How are Academia and Private Industry Using AI?.....	24
How can AI be Used for Public Service?.....	26
What Risks Does an AI World Bring?.....	28
Anticipated Impacts of AI on Employment.....	32
Are Californians Being Prepared for an AI World?.....	36
Are California State Agencies Preparing for AI?.....	41
Are Lawmakers Preparing for AI?.....	42
Resources.....	43

Figures and Graphics

Figure 1: Weak and Strong AI	7
Figure 2: Types of AI	7
Figure 3: Automation and AI	8
Figure 4: Expenditures on Education and Skills Training	9
Figure 5: Sizing the Prize: Which Regions Gains the Most from AI?	12
Figure 6: Feasibility of Automation	13

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Introduction

Artificial intelligence (AI) is already changing the structure of goods and services in the economy, and altering the nature of work. This has major implications for our workforce and opens critical questions about our human values like privacy. The fundamental difference between these challenges and those faced by our ancestors in earlier disruptive eras, like the agricultural or industrial revolutions, is the magnitude and pace of change.

In the period between now and 2030, artificial intelligence will—according to a recent McKinsey report—increase global gross economic product by \$13 trillion.¹ This increase roughly translates to an economic effect in California of well more than \$400 billion.² The impact of artificial intelligence on jobs stretches from job losses of 5 percent to job changes³ or alterations of up to 60 percent.⁴ These percentages are of course estimates and, without more accurate data collection by government, the exact impact on California jobs is hard to predict. It is, however, within the realm of possibility that artificial intelligence could affect from 1 million to 11 million California jobs.⁵ In a future where artificial intelligence is virtually interwoven in the fabric of the economy and daily activities, preserving a sense of human control is vital.

AI poses four key decisions for California: (1) how to support AI research and responsible AI use to grow the state's economy; (2) how to take advantage of advances in AI to enhance services to Californians; (3) how to configure a new structure for lifelong education and training to respond to the inevitable disruption in the tasks or content of work; and (4) how to protect its values of privacy, transparency and accountability in this new economic era.

The magnitude of these challenges is immense. The suite of actions by the next Governor and the incoming Legislature needs to be big, bold and scalable.

The state of California will be well served if its leaders

can work together across the lines of political parties and with stakeholders such as workers, students, educators, researchers and the business community. One of the keys to success will be to configure government, especially the Executive Branch, to embed a comprehensive and cross cutting view of artificial intelligence. This report urges action to create a new Cabinet level position on AI accompanied by an appropriate cross-agency commission. The state of California as the user of AI and as the regulator of some AI products and services should fully engage the public in a robust discussion of AI and serve as a vibrant example of best practices in the use of AI. The opportunity to prepare for the AI world is now; otherwise, California may find itself left behind.

The Governor and Legislature should:

- Engage the public in broad conversations about the responsible use of AI;
- Identify the necessary training and other educational opportunities to build the human infrastructure required for an AI-fueled economy;
- Explore opportunities to form and leverage public private partnerships to use AI to address societal challenges; and
- Examine legislative and policy strategies to preserve and protect key public values: privacy, transparency and accountability.

The policy topics arising from artificial intelligence adoption the state must confront, plan for and solve will be varied, complex and often daunting. To be clear, no single report or legislative session can address all these issues. Rather this report urges the new Governor and Legislature to begin these processes with a sense of urgency and an understanding that the emergence and widespread use of artificial intelligence poses among the most important inflection points for the economy, education and training, employment and societal values in the history of the state.

What is AI and What Opportunities Does it Offer?

Introduction to Artificial Intelligence

Artificial intelligence (AI) is a quality of any computer program (algorithms, data structures and data) that can sense, reason, act and adapt like humans.⁶ While many AI systems can also learn over time (e.g., a spam filter, a recommendation system), not all can do so. An expert system built to aid human reasoning, or an autopilot that can land an airplane, are examples of AI applications that do not learn. Whenever a computer program's performance gains near-humanlike abilities, or better than human abilities, to sense, reason or act, we tend to call that AI.

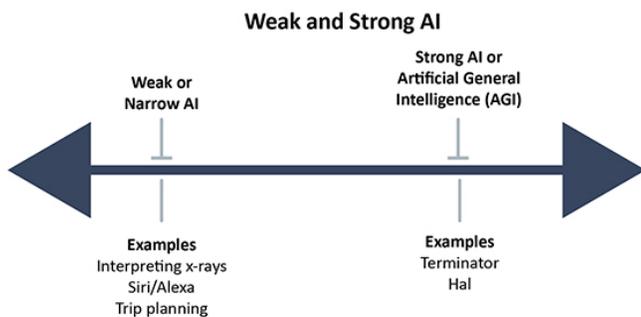


Figure 1

Two types of AI are commonly discussed: weak or narrow AI and strong or general AI. Weak AI are programs that are humanlike on narrow tasks for particular applications. Examples include advanced video game engines, diagnostic technology for interpreting x-rays and anti-collision technology in a car. This is very different from strong or general AI, a smarter-than-human system that functions across multiple areas of human thinking and acting, as depicted in science fiction movies like HAL in *2001*, Samantha in the movie *Her*, or Skynet in *The Terminator*. In reality, narrow AI is already in broad use today, while the arrival of general AI is likely several decades away or more.

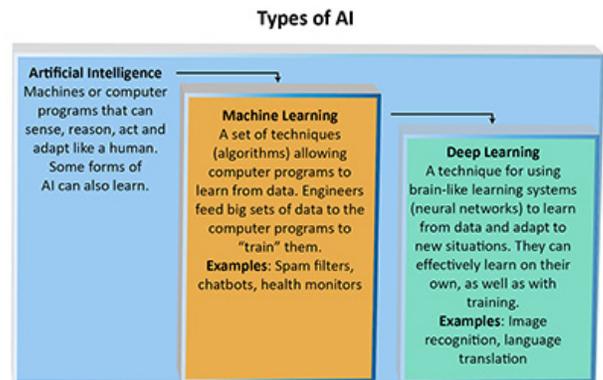


Figure 2

One of the most important sets of AI techniques, which began to make progress in the 1990s, is machine learning (ML). ML is a set of techniques (algorithms, data structures and training techniques) used by engineers to allow computer programs to get better as they learn from new data, either in supervised (human-trained) or unsupervised (machine-led) modes. Many modern computer programs use ML techniques, including search engines, spam filters, recommendation systems, image classifiers, financial trading systems, financial "roboadvisors," scheduling agents, customer service chatbots, environment and health monitors, smartwatches, smartphones, smart speakers and many others. The use of ML has grown substantially because the large data sets necessary for training are now accessible on the web, and the computing power required to use ML techniques is now affordable.

There are at least five major computer engineering approaches to ML.⁷ One that is particularly revolutionizing AI today is called deep learning (DL). DL is a ML technique for using brain-like learning algorithms (neural networks) to filter and learn from large amounts of data, generate probabilistic responses and adapt to new situations. In the early 2010s, DL began to make significant progress on previously very difficult problems, like speech recognition, language translation, language understanding, image recognition and spatial navigation.⁸ DL systems are particularly good at finding hidden values

and relationships in large sets of data, filtering out noise to find signals, putting information together in novel patterns, improving based on user feedback and adapting to new situations in creative ways.

Governments, with their vast data sets and user base, are ideal customers for DL applications. Many are now using DL for document discovery, automating documentation and administration, sensor monitoring, cybersecurity and answering citizen queries with chatbots.⁹ DL systems can have bias and be poorly adapted to their tasks, particularly in their early versions. But they are also learning systems, which allow their performance to get better and safer over time. Just as with human brains, engineers can make DL systems more adaptive by ensuring they begin with good algorithms, good training and good data (broadly inclusive and representative). In the near term, DL based systems are expected to continue to do our most complex AI tasks, like driving cars, identifying faces, monitoring security networks, answering questions in natural language and generally improving our ability to use and learn from data of all types. In the longer term, they show the most promise to become increasingly general in their problem solving and adaptive abilities.

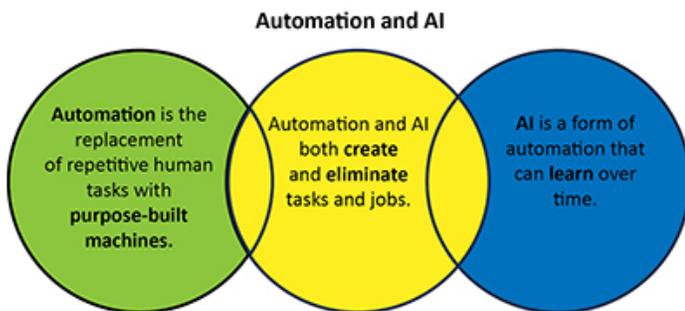


Figure 3

It is worth calling out the relationship between automation, artificial intelligence and task or job creation or elimination. Automation involves the replacement of repetitive human physical or mental tasks with purpose-designed technology. It has been occurring as long as humans have had the ingenuity to mechanize certain forms of work. AI allows the automation of more complex types of human sensing, reasoning, acting or adapting, with technology that can learn and improve over time. Both automation and AI continually create, as well as eliminate, tasks and jobs.¹⁰ Both automation and AI will free up human time and capital, reduce product and

service cost, create wealth and are themselves new tools that become cheaply or freely available to use in new ways. The new tasks and capabilities that tomorrow’s workers will gain by using AI-enabled products, services and platforms in the workplace, the new jobs AI will create and the new forms of training that AI will enable in the workforce, are hard to predict.

Possible Benefits

AI has the potential to revolutionize major areas of life for economic, social and environmental good. The European Commission, as a part of their Digital Single Market series of reports, outlined specific examples of how AI might assist in meeting social needs, including:

- Reducing traffic accidents.
- Improving efficiency in the use of energy and water resources.
- Reducing risks of work-related injuries.
- Detecting pollution and oil leaks.
- Reducing trauma after surgery and helping surgeons operate more precisely.
- Reducing the use of pesticides and need for irrigation.
- Improving access to education.
- Improving speed and accuracy in diagnosis of diseases.

As for jobs, AI could make many easier by performing mundane tasks, thus allowing humans to perform more interpersonal and creative activities.¹¹ Such a transition may likely promote higher productivity and individual job satisfaction. Bank tellers who no longer dispense cash are freed to improve the customer experience and advise management on options for new services. Tony Blair, executive chair of the Institute for Global Change and former UK Prime Minister, said, “AI will allow us to do what it is that we are uniquely meant to do: to focus on high-level thinking, strategy, and paving the way for innovation.”¹²

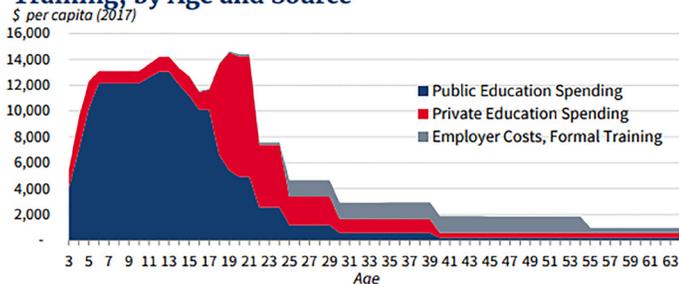
AI will also drive the creation of new occupations, which may help to counterbalance job displacement.

Investments in renewable energy and mitigation of climate change may create demand for workers across several sectors, from manufacturing and construction to installation. Growth in the population of people age 65 and older may create demand for occupations in the health care sector, including doctors, nurses, home health aides and nursing assistants.¹³

The possible benefits of AI are thus significant and should be broadly shared. Consequently, developers and software engineers must be provided proper incentives to develop AI to perform good works. A balance must be struck between AI investments by the private sector and AI training and education for workers. In the United States, spending on formal education has substantially outpaced spending on training. This is concerning because the advent of AI will require a much more nimble workforce. Without proper training, employees may find themselves without the skills necessary to succeed across a variety of sectors.

California’s future labor force therefore stands to benefit from additional worker training and education, and workforce transition programs. These investments will lead to increased public tax revenues and reduced reliance on social safety net programs.¹⁴

Figure 4. Expenditures on Education and Skills Training, by Age and Source



Sources: OECD, U.S. Census Bureau, BEA, BLS, Association for Talent Development (2017), Carnevale et al (2015), CEA Calculations.

Figure 4: Council of Economic Advisors. July 2018. “Addressing America’s Reskilling Challenge.”

The 23 Asilomar Principles

California Assemblymember Kiley, with several co-authors, introduced Assembly Concurrent Resolution 215. The resolution was enacted on September 7, 2018. Over 1,200 AI and robotics researchers signed the principles, which are intended to promote the safe and beneficial development of AI. Below is a sampling:

- #3 Science-Policy Link:** There should be constructive and healthy exchange between AI researchers and policymakers.
- #8 Judicial Transparency:** Any involvement by an autonomous system in judicial decision-making should provide a satisfactory explanation auditable by a competent human authority.
- #12 Personal Privacy:** People should have the right to access, manage and control the data they generate, given AI systems’ power to analyze and utilize that data.
- #15 Shared Prosperity:** The economic prosperity created by AI should be shared broadly, to benefit all of humanity.
- #20 Importance:** Advanced AI could represent a profound change in the history of life on Earth, and should be planned for and managed with commensurate care and resources.
- #23 Common Good:** Superintelligence should only be developed in the service of widely shared ethical ideals, and for the benefit of all humanity rather than one state or organization.¹⁵

How Governments are Preparing for AI

Artificial intelligence has the potential to change dramatically how governments do business, provide public services, predict and respond to natural disasters, conduct intelligence, improve national security and fight wars. More importantly, governments must implement strategies and policies to encourage the private sector to participate meaningfully in AI policy development. Consequently, countries around the globe and even states and cities in the United States are taking early steps to understand and take advantage of AI technology and applications. California can learn from and expand upon recent advances made by the United States government, other states and foreign governments.

United States Federal Government

The Trump Administration in May 2018 pledged it would prioritize funding for AI research and development as a means to economic growth and announced the formation of the Select Committee on Artificial Intelligence, a task force under the National Science and Technology Council, to promote a national approach to the development and use of AI.¹⁶ Subsequently, the United States House of Representatives, Committee on Oversight and Government Reform Subcommittee on Information Technology issued a report in September 2018, *Rise of the Machines, Artificial Intelligence and its Growing Impact on U.S. Policy*. The report recognizes that the “United States cannot maintain its global leadership in AI absent political leadership from Congress and the Executive Branch” and recommends “increased engagement” by the federal government.¹⁷ Congressional members have introduced legislation to better understand how rapid AI innovations may benefit Americans. A bipartisan Congressional Caucus on Artificial Intelligence was created in 2017 to consider the implications and opportunities of the technological, economic and social impacts of advances in AI.¹⁸

Other Countries

Many other countries are developing and implementing AI policies at a record pace. Below is a sampling of their efforts.

Europe: In April 2018, the European Commission proposed a multi-pronged approach to boost investment and set guidelines for AI among the European Union’s 28 member states. The Commission’s strategy includes: investing €20 billion in AI research and innovation by the end of 2020; modernizing education and training systems; supporting labor market transitions to prepare for socio-economic changes; and establishing ethical guidelines for AI development that take into account data protection, transparency, and other concerns. In addition, the Commission appointed 52 experts to a new High-Level Expert Group on Artificial Intelligence (AI HLEG) that includes members from academia, civil society, and private industry. The AI HLEG will provide recommendations for future AI-related policy development, including ethical, legal and societal considerations. In addition, the AI HLEG will advise the Commission on mid to long-term AI challenges and opportunities and propose ethical guidelines.¹⁹

France: After a six month review, the French government unveiled a national strategy for artificial intelligence technology in 2018, including plans to invest €1.5 billion over the next five years. The review considered possible applications of the technology and the role of government in several specific sectors: health, ecology, transport and mobility, and defense and security.²⁰

Switzerland: In a pilot program overseen by the Swiss State Secretariat for Migration and the Immigration Policy Lab, refugees seeking asylum in Switzerland will be placed in different parts of the country using an algorithm designed to maximize their chances to find employment.²¹

Russia: Russia is investing in artificial intelligence, particularly to support the nation's military. Reports suggest that the Russian military is designing autonomous vehicles to guard its ballistic missile bases and an autonomous submarine capable of carrying nuclear weapons. The Russian military is also experimenting with battlefield robotics, such as remotely piloted tanks.²²

China: Like Russia, China invests heavily in artificial intelligence to boost national security and increase military capabilities. In 2017, China's government issued a plan to lead the world in artificial intelligence technology by committing to invest capital resources into AI research and development. The plan also provides guidance and policy on artificial intelligence development.²³ Weak privacy laws allow China to provide its AI industry with access to data on more than 1.4 billion citizens.²⁴ To ensure a workforce capable of supporting national AI goals, Chinese schools include AI-related courses in primary and secondary education.²⁵

South Korea: Known for cutting-edge industrial robotics technology in its automotive, electronics and semiconductor industries, South Korea plans to invest ₩2.2 trillion (U.S. \$2 billion) by 2022 to strengthen its artificial intelligence research and development capability.²⁶ In addition, the nation intends to establish six new research and development institutes, which will be focused on human resources, technology and infrastructure.

Japan: Japan's Strategic Council for Artificial Intelligence Technology released a formal artificial intelligence strategy in March 2017. The plan acknowledges the need to develop technology researchers, engineers and data scientists capable of growing the industry sector. It also outlines a multi-pronged strategy for government to promote the infrastructure necessary to support artificial intelligence capabilities, particularly in the areas of productivity, health, medical care, welfare and mobility.²⁷

U.S. States & Select Cities

Various states have a head start in addressing implications of AI.

Indiana: Indiana state leaders created The Future of Work task force to study new technologies and devise innovative workforce development strategies to drive

economic growth and productivity. To date the task force has considered state and national workforce trends, the kinds of skills needed in a changing economy and implications for Indiana's universities and how changing economic forces may impact vulnerable populations.²⁸

Massachusetts: In November 2017, Massachusetts established a Commission on Digital Innovation and Lifelong Learning at the Massachusetts Institute of Technology to examine how the state can expand affordable, high-quality, employer-aligned education, training and lifelong learning opportunities in an era of technological change.²⁹

Michigan: Michigan's Department of Licensing and Regulatory Affairs uses artificial intelligence and machine learning technologies to predict the likelihood of drug related deaths and reveal other insights into the state's opioid epidemic.³⁰

New York: New York lawmakers in December 2017 created a temporary, unpaid commission to investigate how to regulate artificial intelligence. Among other topics, the New York State Artificial Intelligence Commission would study current state law related to artificial intelligence, examine the impact of AI on employment and the disclosure of confidential information and the potential impact of the technology industry of proposed regulations.³¹

Vermont: In May 2018, Vermont's Governor signed legislation to create a task force to develop recommendations on the responsible growth of the state's emerging technology markets, the use of artificial intelligence in state government and the state's regulatory role in the field of artificial intelligence.³²

Washington: To stay up-to-date on workforce changes due to automation, AI technology and other factors, the state of Washington established the Future of Work Task Force. Among other responsibilities, the task force will inventory and assess industry trends, identify policies to help Washington's businesses and workers respond to rapid changes in technologies and create a policy framework to support lifelong learning.³³

Hawaii: Hawaii created a working group to consider whether to implement a universal basic income (UBI) program in Hawaii.³⁴ Under a UBI program, every citizen

is granted a fixed income that is not dependent on their status in life. The UBI concept has received attention and appeal, because it could minimize the impact of automation and AI technology on jobs.³⁵

New York, NY: In January 2018, the New York City Council passed legislation to create accountability for algorithms by establishing a task force to study how city agencies use algorithms to make decisions that impact people and whether those systems appear to discriminate against people based upon such protected characteristics as age, race, religion or gender.³⁶

Pittsburgh, PA: The City of Pittsburgh, Pennsylvania is using artificial intelligence, among other technologies, to transform itself into a “future city.” Since 2015, city officials have partnered with The Heinz Endowments to forge a new model of urban growth and development, fueled by innovation, robotics, automation and artificial intelligence. Dubbed P4 Pittsburgh—emphasizing the framework of people, planned place and performance—the project will explore how cities adapt to rapid technological changes, while addressing social and economic inequality, environmental threats and the built environment.³⁷

How is California Preparing

With the exception of the Governor’s Office of Business and Economic Development (GO-Biz), Department of Technology and the California Department of Food and Agriculture, California’s state government has not kept pace with national, state and even city governments on organizing efforts to address the implications of AI. Given its extraordinary intellectual and innovation resources and, as the fifth largest economy in the world, California has the opportunity to marshal not only its public and private resources to immediately begin addressing the implications of AI but to begin taking advantage of AI to enhance services to Californians and become the world leader in adopting thoughtful policies to ensure AI positively impacts the state’s economy and, more importantly, all of its constituents.

Although the proliferation of innovation in the AI field will impact and ultimately transform the labor market, the extent and timing of such impacts remains unclear. Studies throughout the world reach different conclusions. Some researchers predict job losses due to automation, while others anticipate job growth, and still others suggest the nature of work, specifically the tasks that

Sizing the prize – Which regions gain the most from AI?

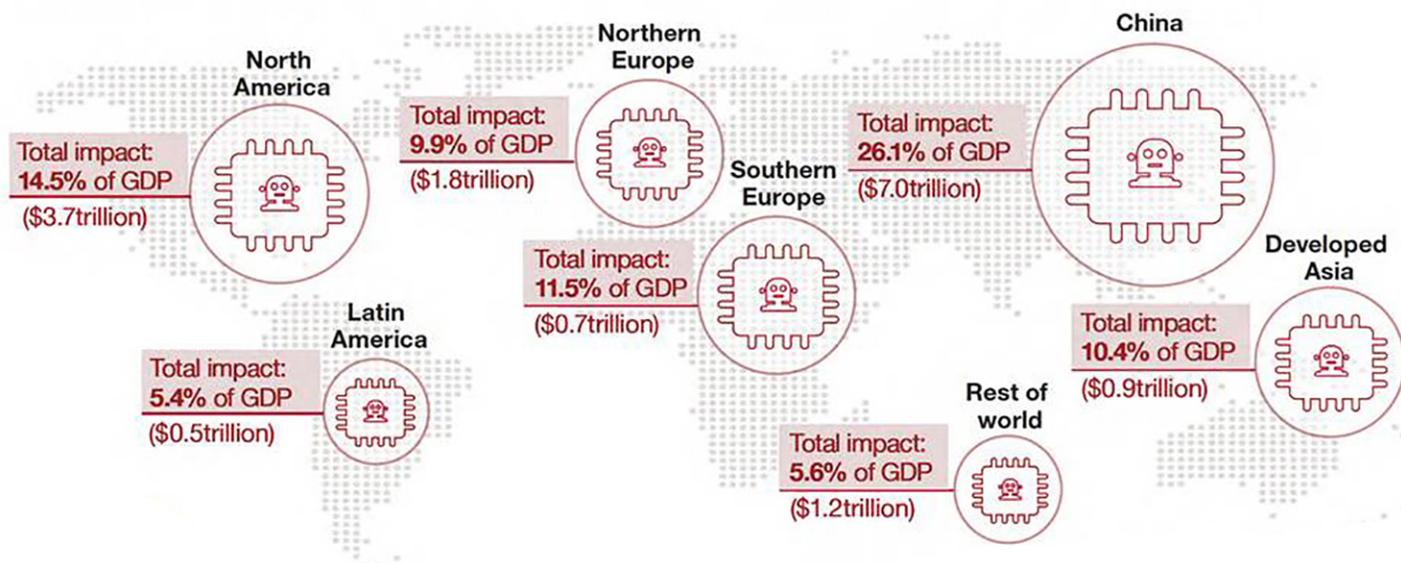


Figure 5: PricewaterhouseCoopers. June 2017. “PwC’s Global Artificial Intelligence Study: Sizing the Prize.”

comprise work, will change. The Commission heard testimony from diverse groups confirming the disparity of such opinions in California. Notwithstanding the varying opinions, a general consensus exists among experts that lawmakers, educational institutions and private sector policymakers must act quickly to influence not only the impact of AI on employment, but to propel California as a leader in the transition of the labor force as a result of AI and accelerate statewide economic prosperity emanating from AI.

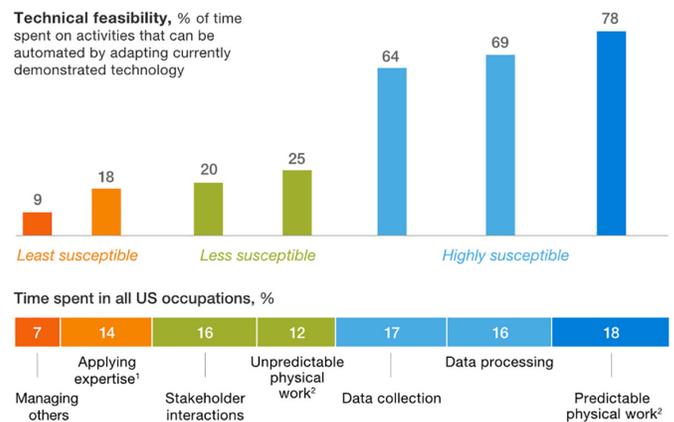
To predict trends in its workforce, the various state departments have insufficient data and data collection processes to accurately predict how artificial intelligence may impact California’s workforce. The lack of accurate data stems from outdated national employment models on which state departments rely. The models predict workforce development based on historic trends.³⁸ This type of information will not account for the rapidly developing effects of automation on California’s future workforce. While the state requests additional data from private sector employers through voluntary surveys, low participation in these surveys affects the reliability of the information.³⁹ California must develop an accurate method of predicting labor needs with the advent of AI and automation. For example, the California Community Colleges Centers of Excellence (COE) for Labor Market Research uses their own economic modeling to customize state projections. COE conducts special projects to better understand the workforce needs in evolving and emerging industries. By conducting point-in-time surveys and talking to employers in controlled ways, COE has more accurate real time information of job trends. Expanding the role of COE would require legislative approval.⁴⁰

The threat of job loss stemming from an increase in automation and other AI-based technologies has elicited doomsday scenarios featuring job-stealing robots. Others predict a possibility that automation will create more jobs than it would eliminate. Ultimately, it appears likely that AI will accelerate the transformation of many jobs. National labor market trends provide some insight on how new technologies might change the labor market, both nationally and in California. Researchers predict job losses due to automation, but for more workers, the nature of their job likely will change through partial, rather than complete, automation of activities, or by working alongside robots and smart machines

to complete critical job tasks.⁴¹ Economists point to historical examples of new technologies that increased the demand for workers to focus on tasks that machines could not. An often cited example is the advent of the ATM machine, which performs routine banking tasks for customers, thus permitting bank tellers to provide other, less routine, banking services to customers.⁴² In addition, automation and AI created human efficiencies may alleviate the impact of job attrition caused by baby boomer retirements. Potential results include a higher skilled workforce and higher median wage.

To achieve these results, California must expedite the adoption of policies addressing the impending new workforce demands. While the immediacy of adoption is critical, such policies should address access to training among all demographics and skill levels in California. The state can partner with non-profit organizations to establish better online portals for access to skill assessments, training resources and job search tools, such as the Council for Adult and Experiential Learning (CAEL). California also can actively notify workers once they apply for unemployment insurance that they qualify for unemployment insurance benefits if they participate in approved training.⁴³ Provided it could expediently implement workforce training and retraining policies, the state should prioritize collaborations with stakeholders

Analyzing work activities rather than occupations is the most accurate way to examine the technical feasibility of automation.



In practice, automation will depend on more than just technical feasibility. Five factors are involved: technical feasibility; costs to automate; the relative scarcity, skills, and cost of workers who might otherwise do the activity; benefits (eg, superior performance) of automation beyond labor-cost substitution; and regulatory and social-acceptance considerations.

¹Applying expertise to decision making, planning, and creative tasks.
²Unpredictable physical work (physical activities and the operation of machinery) is performed in unpredictable environments, while in predictable physical work, the environments are predictable.

Figure 6: McKinsey and Company. July 2016. “Where Machines Could Replace Humans – and Where They Can’t (Yet).”

from affected demographics, including broad access to the opportunities emanating from the implementation of AI. For example, to address changes in the trucking industry resulting from autonomous vehicles, U.C. Berkeley researchers suggest policymakers design job-quality standards to ensure living wages and good working conditions for drivers and create regulations to incentivize clean trucks to reduce pollution and other environmental and public health costs.⁴⁴

Values: Autonomy, Responsibility, Privacy, Transparency and Accountability

There is no doubt that the use of algorithms in decision making poses a risk of error and bias. The public policy question is what to do about these challenges and how to balance the benefits against the risks. For California government, the first task is to help educate and inform policymakers in state government, including within the executive branch and departments, agencies and commissions, on how algorithms are created, tested and used. As a state with the best and strongest set of research universities in AI, California should sponsor research and development in this area.

Beyond that, an array of policy choices must be confronted. These policy approaches range from intrusive regulations that require permission before AI is used to softer, non-governmental standards and self-regulation.

Some of the options California could consider include:

1. Industry based standards of disclosure and explanation of algorithms (including relevant data sources and programming assumptions and any risks of bias due to the demographics of the human programmers) aimed at improvements in design and implementation to avoid unwarranted bias.
2. Legally mandated disclosure or algorithm explanations of varying detail.
3. Public sector procurement rules, including selected use of open source mandates for some state contracts.
4. Sector specific rules with focus on the risks in the most sensitive fields such as criminal justice, health and matters affecting privacy.

5. Assignment of a pre-market approval role for some or all AI-related products.

There are competing interests in making choices in this area. California should carefully weigh and assess the social and economic benefits of using AI against the nature and extent of risks associated with bias. It will be important to recognize that a single state of the United States can be both a leader and a potential roadblock. California has led the way in matters like fuel efficiency for cars, but if not careful, could end up creating a moat around AI that leaves the state and nation worse off, particularly if regulations slow or reduce American interest in this highly competitive global race. The easier answers are likely also wrong. Too much regulation can block or deter adoption even when the use of AI can improve outcomes and lower costs. Just as regulators today in all fields must balance benefits against the cost of risks, so it will be true here. The best approach for California in the short term is to learn more about the promise of AI and its pitfalls long before taking permanent and disruptive action.

Agenda for Change

AI Roadmap

California is poised to be a natural frontrunner in the race to prepare for AI, given its large economy and location, which serves as the home base for cutting-edge academia and private research into the development and use of AI technology and applications. Yet, because the field of AI is fast moving and changing, developing a strategic statewide response will require both innovative and dynamic leadership.

California state government is underprepared to take the lead. It lacks any single clear leadership and focus on the development and use of AI technology and applications to improve internal and external operations and services within an ethical framework. Nor has it begun the necessary work to forecast and prepare for the inevitable changes the new technology will impose on the state's workforce and economy. This void could leave California flatfooted in a highly competitive race for AI superiority where only the winner takes all.

However, the Governor and the Legislature have the opportunity to fill this void and can provide the vision, coordination and sustained, unified effort for California state government to plan for and use AI technology for economic, social and environmental good. State government leaders should begin now to educate themselves about the implications, benefits and risks of AI-powered technology. As a start, the Commission urges the Governor and Legislature to take appropriate action and measures specific to the challenges and risks inherent with AI technology and applications and begin to formulate a policy agenda in early 2019. The goals of the agenda should be to grow the state's economy, take advantage of AI to enhance services to Californians, reconfigure its educational institutions to provide necessary education and training, improve data collection and sharing while protecting sensitive data and promote privacy, transparency and accountability in the development and use of AI.

Accordingly, the Commission makes the following recommendations to assist the Governor and Legislature in these efforts:

Recommendation 1: The Governor should appoint an artificial intelligence (AI) special advisor within the Governor's cabinet. This position should report directly to the Governor or to the Governor through his or her designee. Among other duties, the AI special advisor should:

- Coordinate with AI counterparts within state and local agencies, offices of other elected state officials and California's higher education institutions.
- Create a strategic plan that incorporates AI within state government to improve and augment internal and external operations and services, and also oversee the safe, beneficial and transparent deployment of AI technology and applications in state government. The plan should account for changing job requirements due to AI technologies and how to mitigate the impact of AI on jobs with apprenticeship, training and educational opportunities.
- Provide the Governor with annual reports documenting any advances, deficiencies or other relevant information regarding the planning and use of AI by state agencies and standalone departments.

Recommendation 2: The Governor and Legislature should require each state agency or standalone department to designate a chief artificial intelligence officer. This position should report to the agency secretary and coordinate with the Governor's AI special advisor. Among other duties, the chief AI officer should:

- Develop, coordinate and implement the agency's AI strategies.
- Consider the designation of similar positions within the agency's departments, particularly in

departments which may be significantly impacted by artificial intelligence.

Recommendation 3: The Governor and Legislature should encourage the designation of a chief AI officer within independent offices to partner on developing a statewide AI strategy. Such offices may include:

- The State Controller.
- The State Treasurer.
- The Secretary of State.
- The Trustees of the California State Universities.
- The University of California Board of Regents.

Recommendation 4: The Governor and/or Legislature should require each state agency, which includes departments, boards, commissions and the like, to devise strategic plans that include the use and implementation of AI technology and applications to improve and enhance the agency’s internal and external operations and services within an ethical framework that promotes the use of AI for economic, social and environmental good.ⁱ The strategic plan should also include strategies to minimize the impact of AI technology and applications on jobs and job classifications.

Recommendation 5: State government, including the executive branch and independent entities such as local school districts, government funded or subsidized training providers, the U.C. system and the California State University (CSU) system, as well as regional workforce development entities, should create and implement a comprehensive strategic plan to better assure that future workers are prepared for the new skills required for the jobs in a rapidly evolving workplace focused on the application of technology including AI.

ⁱ The use of AI technology and applications may be particularly poignant for agencies and/or departments that have missions critical to health, safety, law enforcement and the protection of California’s natural resources and wildlife. The impact of natural disasters, such as earthquakes, floods, storms, wildfires and droughts, can be catastrophic to people, the environment, domestic animals and wildlife and infrastructure. Commissioners heard how AI can improve emergency response and firefighting efforts. AI technology and applications, thus, present opportunities that California can ill afford to ignore.

This plan should include steps necessary to expand access to and understanding of computer sciences in order to upskill both current and future workers. Other scientific disciplines related to AI such as psychology, mathematics, statistics, ergonomics and engineering curriculum should also be revised to ensure that education and training methods, and skill assessment tools match up with future workforce projections. Importantly, the study of ethics in the development and use of AI should become a core competency for those seeking AI education and training.

This plan should integrate public input and participation of the private sector to make sure public institutions understand the scope, nature and pace of employment changes anticipated by the private sector.

The plan should recognize and stress the vital importance of consulting with and listening to the existing workforce, including union representatives. This will be especially important for state workers, because the state should serve as an exemplar for employers that make AI beneficial for all stakeholders, including employees.

A short term goal of the plan should be to provide details for apprenticeships and other on-the-job training that will facilitate the transition of workers into new and changed workplaces. Broadly sharing the benefits—as embodied in the Asilomar AI Principles—is already state policy, so implementing these programs in state government should be an early priority.

Recommendation 6: The state of California—in recognition of the central importance of relevant, useful and unbiased information—should implement changes to improve the collection of data on jobs and skills for future workers. Once collected and reviewed to assure validity and utility, it should be state policy to operate on the basis that data should be widely and easily shared within all parts of state government provided privacy is assured. A similar presumption should apply to sharing data with the private sector when the benefits exceed the risks and appropriate governance rules and compliance systems are in place to protect personal privacy. The initial focus should be on data related to addressing issues of skills and future job trends. This data should become useful to improve the likelihood that public policy aims to focus on equity, mitigating income inequality and ending unfair distribution of government benefits, funding and services

based on impermissible discrimination and to avoid unfair geographic effects.

Recommendation 7: The Governor and Legislature should create an AI commission made up of knowledgeable professionals and experts in the field of AI from private industry, governments, nonprofits, unions and academia, for the purposes of: (1) developing AI-related demonstration projects for critical state services; (2) incorporating successful AI-related demonstration projects into the state system; and (3) further advancing how data science can be effectively utilized by state government.

Recommendation 8: The Governor and Legislature should ensure an environment in California of continued and sustained efforts to stimulate investment, research and development into AI technologies and applications within an ethical framework that promotes AI for economic, social and environmental good. This effort should include collaboration with stakeholders.

Recommendation 9: The Governor and Legislature should improve the data collection related to at-risk jobs. In particular, consideration should be given to requiring the Employment Development Department (EDD) to develop an addendum survey to the Bureau of Labor Statistics (BLS)'s survey that asks questions about the impact on jobs of automation and, specifically, AI technology. To maximize the collection of data related to at-risk jobs, there should be improved evaluation of data that, at a minimum, identifies how the impact of AI technology and applications will differ by region, county, employment sector, socio-economic group, educational attainment, age group, gender and other appropriate characteristics.

The EDD uses the federal BLS employment surveys, but the Commission's study found a two-fold problem with the BLS surveys: (1) many tech companies do not fill out the surveys; and (2) the surveys do not ask questions specific to job loss or change due to the automation of jobs.⁴⁵

Recommendation 10:

The Governor and Legislature should promote apprenticeships and other training opportunities for employees in private industry, and state and local governments whose jobs and/or classifications may be displaced or transformed by AI technologies and applications.

California state government employs more than 232,000 employees.⁴⁶

Public Engagement

Public officials and policymakers in state government are accountable to the people. Part of that responsibility is for them to engage and educate residents of the state. Many matters before the Governor, including executive departments and agencies and the Legislature are debated and decided by relatively few people and often without full public transparency. In the case of artificial intelligence, because the scope and extent of its utilization, more must be done to inform and listen to the general public. This is true, in part, because virtually all current students will be entering a workforce shaped by the application of AI. Most current workers will see some changes in the nature of the work they perform as a result of AI. Some categories of jobs will be sufficiently disrupted that those jobs may disappear. The exact nature and extent of these changes is not known, but more than a handful should know about the potential for positive outcomes and about steps that could be taken to mitigate any harm.

In the case of artificial intelligence, there has been substantial press coverage, but the level of fundamental understanding remains low. Most of the debate has been about the consequences of AI and not about what it is, how it can be applied or how to balance between the potential for progress and risks. In the case of AI, we recommend California plan for and execute public engagement using a suite of tactics that reach people where they are most likely to accept news and facts.

As a representative of the American Association for the Advancement of Science put it: "We need to engage the public in a more open and honest bidirectional dialogue about science and technology and their products,

including not only their benefits but their limits, perils, and pitfalls.”⁴⁷

Public engagements need to reach a broad cross section of the public, be seen as fair and balanced and be structured to listen as much as inform. Public engagement consists of tools such as:

- Public hearings, both legislative and by agencies of government;
- Written, video, audio and online presentations and interactive techniques; and
- Online surveys and other tools used by other nations such as Denmark, France and the United Kingdom.

These approaches include principles such as: (1) quality of outcomes; (2) legitimacy of outcomes; and (3) administrative efficiency. These principles have been embodied at the federal level in a set of principles of public engagement supported by federal law (the Administrative Procedures Act) and informed by a commitment to a framework of “responsible innovation” that is “transparent, interactive process by which societal actors and innovators become mutually responsible to each other with a view to the (ethical) acceptability, sustainability, and societal desirability of the innovative process and its marketable products.”⁴⁸

Public engagement is central to the development of a societal consensus. Past experience on vexing and complex scientific issues suggests that setting aside funding for reviewing ethical, social and legal issues is vital.ⁱⁱ

Key Issues in Building a Human Infrastructure

1. What is the scale and changing nature of work due to AI? How many jobs will be gained and lost by type?
2. What will be the pace of the changes in jobs due to AI?
3. What types of jobs will change and when will they be most affected?

ⁱⁱ The Human Genome Project provides an example: <https://www.genome.gov/10001618/the-elsi-research-program/>.

4. What are the education and training requirements for major current job categories and how well to existing institutions of government meet those needs?
5. What is the gap workers will face between their current skills and new job requirements over the next 20 years due to the changing nature of work arising from AI?
6. Should California establish a lifelong learning account? How should it be structured, who should run such a program, how much will it cost and how should it be financed?
7. What changes, if any, should be made to the unemployment insurance program to integrate into a method for securing improved worker training?
8. What changes should be made with respect to better preparing students for AI in: (1) the University of California system, (2) the California State University system, and (3) California Community College system? Are any changes necessary in curriculum, financing tuition, the duration of enrollment or the types of degrees or certificates offered?
9. What role should the private sector play in worker training? What role should state policy play in encouraging or subsidizing such training? How can the private sector assure training in more remote, rural or hard to reach urban communities? What role should apprenticeship programs play? What role should organized labor play in education and training?
10. What changes should be made by state government to prepare the current and future workforce for AI? What role should state government unions play?

Attacking Pressing Social Needs Using AI

Several witnesses and experts told the Commission that social needs can be addressed and outcomes improved through the application of AI. Examples include access to and use of state controlled data such as anonymous electronic health data, especially from the University of California health system. Efforts are already underway to use this testbed to derive insights into better diagnostic and treatment options. Others have suggested the use of AI to improve the identification of potential recipients of social services, such as teenaged homeless youth. Yet others have pointed to many potential uses of AI

in responding to climate change, including planning to optimize the use of intermittent energy sources such as wind and solar.

This report does not urge any specific public private partnership on these, or other, specific areas of societal concern. Rather we urge state leaders to examine the application of this tool to any appropriate field where it fits and optimizes benefits to the residents of the state.

1. What areas of social need are most amenable to be addressed using the tools and techniques of AI?
2. What are the optimal formulas for creating public private partnerships? What should be the principles of governance and accountability for such entities?
3. What role, if any, should the state play in financing public private partnerships?
4. What examples exist in other jurisdictions or on other topics from which California can learn?

Protecting Our Values

It is well accepted that AI and its use has privacy implications. Political jurisdictions such as the European Union have implemented new rules that cover AI. Closer to home, the California Legislature passed and the Governor signed a new privacy statute, the California Consumer Privacy Act of 2018. The best next step for the incoming administration and Legislature to examine over time that statute to determine how effectively it is working and whether it is a good fit for AI-related issues.

It will be useful to review the AI-related privacy principles of non-profit groups, companies and their trade associations, as well as those recently drafted by Congressman Ro Khanna.⁴⁹ These principles offer additional insights into AI-related privacy questions.

Questions associated with transparency and accountability are complex and fraught with risks of unintended consequences. Moreover, rules in this area potentially can be overly inclusive, under cover key issues or insufficiently address unique challenges faced by specific sectors (e.g., autonomous vehicles).

The California Consumer Privacy Act of 2018 establishes consumer rights over their personal information. The Act includes rights related to disclosing personal information, deleting personal information and stopping a business from selling personal information.⁵⁰

SUPPORTING MATERIALS AND RESOURCES

Overview of the Commission's AI Study

Artificial intelligence (AI) technology and applications are certainly here in our everyday lives from smartphones to digital personal assistants. AI, however, has the very real potential to become something more than a fun and entertaining technology. AI may very well become immersed in every major area of our work and personal lives: transportation, communications, finance, health care services, emergency response services, community planning, criminal justice and entertainment. The list goes on and is only constrained by our imaginations. Right now, the imaginations of researchers, business executives, academics, software engineers and the like into the potential uses and applications of AI-based technology appears limitless.

There is a fierce race underway by governments, large and small, to prepare for smarter and smarter machines. Where is California in that race? This is the question the Commission sought to explore in this study. The Commission researched, reviewed and analyzed hundreds of articles and white papers on the development, use and trends of AI technology and applications. The Commission also held one formal hearing in January 2018 and two advisory committee meetings in May and August 2018. The Commission heard testimony and received comments from industry experts, government officials, academia, business leaders, technology associations and other stakeholders.

The Commission found that while California state government has made some strides to use modern technology to improve internal and external operations and services, the government as a whole is not AI savvy or well prepared for the inevitable changes that will be brought by smarter and smarter machines. California state government lacks an infrastructure, AI strategic planning and targeted measures geared toward taking advantage of AI opportunities and minimizing AI risks.

Given the speed with which AI advances are being made, the Commission urges the Governor and Legislature to take appropriate action and measures specific to

AI technology and applications early in 2019. The recommendations in the Commission's report are intended to assist the Governor and Legislature in that effort. In this appendix, are supporting materials.

Sectors Impacted by AI

Experts predict that rapid progress in the field of automation relying upon artificial intelligence will continue, penetrating and redefining the nature of work and the workplace. Such revolution will bring profound changes for the way private industry and government operates. Its transformative potential already is evident across a number of industry sectors from agriculture and health care to education and transportation.



Agriculture

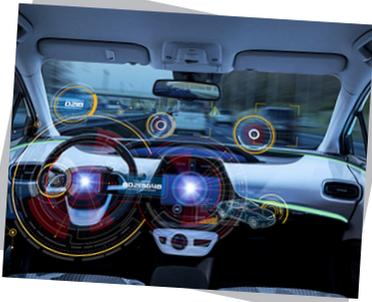
The increasing availability of data is paving the way for robots to harvest firm fruits, for algorithms capable of accurately detecting and classifying plant pests and disease and other technologies that can predict crop yield. In the future, artificial intelligence may be applied to biotechnology and plant breeding to improve the efficiency of crop production.⁵¹

All Roads
Lead to
AI



Education

Intelligent tutoring systems and online learning will allow teachers to instruct students in different languages or drastically increase class size to reach more students efficiently. Artificial intelligence may be useful in filling the gaps in subject areas in which a teacher does not have a particular expertise.⁵²



Transportation

Artificial intelligence has spurred GPS-enabled smart cars and enabled the adoption of smartphone technology that provides real-time sensing and prediction of traffic, route calculations and ride-sharing.



Manufacturing

Amazon, a company known for manning its warehouses with robots, is now using machines to make critical inventory decisions, rather than tasking employees with decisions that can be automated.⁵⁵ Future applications of artificial intelligence in factories have the potential to create new manufacturing markets, improve workplace safety and more accurately project market demand.⁵⁶



Energy

Machine learning and analysis of electricity-consumption patterns are helping to make informed, real-time decisions about maximizing energy efficiency. Utilities can predict and meet constantly changing energy needs by analyzing data across electrical grids. Machine learning algorithms can forecast the occurrence of solar flares, which can disrupt power grids and satellites.⁵³



Health Care

Artificial intelligence has the potential to help people manage their own health care and maintain health through a healthier lifestyle. For example, the Smart belt has a built-in magnetic sensor that tracks waist size and tension to determine when users may have overeaten and, if so, offers an alert.⁵⁴

How are Academia and Private Industry Using AI?

The uses of AI in academia and the private sector range from absolutely fun to profoundly life changing. There are so many AI applications being used today, this study could not adequately address them all. Therefore, the following provides a glimpse into an ever growing landscape where the seeds for imagination flourish.

There are important AI business uses that improve how certain tasks are performed. For instance, Adobe Sensei is described as using AI and machine learning to help users discover hidden opportunities and make tedious processes faster. Sensei, a word in Japanese meaning teacher, is also described as having three types of intelligence: creative, content and experience.⁵⁷ Adobe is working on enhancements to Sensei, such as making it easier for marketers to search for images in Adobe's stock service without needing to use words to describe what they are looking for. In a function called selective similarity, Sensei will allow users to mask areas of an image and have the system find the related photos or illustrations.⁵⁸

IBM is on the move with its Watson AI technology in ways that promote business, fun and health. Last year, they announced a partnership with Rocket Fuel to embed IBM's Watson AI technology into Rocket Fuel's systems to identify key words and sentiments that might help predict the interest of consumers in certain advertisements.⁵⁹ Last football season, IBM introduced IBM Insights, which is a tool its Watson AI technology uses to scan and parse the web for fantasy football advice on a weekly basis. Watson can assist with deciding which quarterback to play or which flex player to start.⁶⁰ Watson is not all fun and games, however. In 2016, IBM showed that Watson may have a heart. As part of former Vice President Joe Biden's National Cancer Moonshot Initiative, IBM began collaborating with the U.S. Department of Veterans Affairs aimed at providing access to precision treatment options for over 10,000 patients fighting cancer. Oncologists have used Watson for genomics to identify mutations in cancer cells DNA for more than 2,700

veterans, which make up roughly 3.5 percent of cancer patients in the U.S.⁶¹

Microsoft is another leader in developing AI technology. In its 2017 vision statement, the company dropped a reference to "mobile-first and cloud-first world" in exchange for "an intelligent cloud and intelligent edge infused with AI."⁶² Within Office, Microsoft uses features driven by AI, such as live translation of recorded speech. In 2017, Microsoft acquired Maluuba, a Canadian technology company founded in 2011 by students at the University of Waterloo. The company creates programs that use natural-language processing, allowing computers to understand words and develop reasoning capabilities.⁶³

Digital Democracy is a project of the Institute for Advanced Technology and Public Policy at the California Polytechnic University, San Luis Obispo. The free online platform uses AI to create a searchable database of all statements made in state legislative hearings, such as in California and Florida, and can be used by citizens, journalists, organizations and researchers. Digital Democracy goes beyond providing information, allowing the use and sharing of information on media platforms like Facebook and Twitter. "Digital Democracy empowers every Californian with unprecedented access to their government. The result will be greater accountability."⁶⁴

One Concern is an AI company with one very important concern: saving the planet from natural disasters. "By 2030, 60 percent of the world's population will live in cities with 1.4 billion facing the highest risk of exposure to a natural disaster." The company's vision is to ensure "that everyone lives in a safe, sustainable, and equitable world." The mission of the company may be even bigger: "drive deep social impact through benevolent intelligence to save lives and livelihoods." This lofty goal is not surprising given that CEO Ahmad Wani survived being marooned during the 2014 Kashmir flood for seven days, wondering if he would live or die.

One Concern's AI products allow governments and other customers to predict and react to the impacts of natural disasters and conduct multi-hazard analysis of infrastructures.⁶⁵ In addition, the company partners with emergency operations centers in San Francisco, Los Angeles and Woodside to provide instant recommendations on response priorities and resource allocation.⁶⁶

Dutch agritech company Connecterra uses Google's TensorFlow, an open source machine learning framework, to help farmers keep their cows healthy. Many call it "Fitbit for cows."⁶⁷

How Can AI be Used for Public Service?

Although the risks and complexities of artificial intelligence must always be measured and considered, the question of AI's potential to do good for the economy, society and the environment, may be summed up in one word: limitless. Artificial intelligence could improve substantially lives, jobs, businesses, health care, government services, education and much more. This section does not attempt to explore all those ways. Instead, the focus is on a sampling of services critical to California's well-being and future.

Fighting Fires

Machine learning algorithms can supply fire crews with data-driven predictions on when and where forest fires will occur.⁶⁸ Surveillance drones powered by artificial intelligence can scan and assess images of the ground to accurately detect an early-stage wildfire.⁶⁹ An AI tool developed by NASA can guide firefighters by tracking their movements, identifying hazards and facilitating communication.⁷⁰



Education



AI systems allowed school administrators in Tacoma, Washington to identify at-risk students and intervene to provide assistance. Within a few years, the graduation rate was raised by nearly 30 percent.⁷¹

Emergency Response

AI can assist government agencies and scientists to monitor tremors, floods and other possible natural hazards. AI can also process and fast-track calls to dispatchers, while filtering out redundant or less urgent requests.⁷²



Environment



AI could promote biodiversity and water conservation, and protect endangered species.⁷³ Machine learning can identify the presence of invasive species and diseases in plants and eliminate them.⁷⁴

HIV Prevention Among Homeless Youth

The USC Center for Artificial Intelligence in Society uses an AI algorithm to select homeless youth who have the potential to be influential leaders. They are trained to deliver and promote HIV prevention information. Compared to traditional methods, the approach has resulted in homeless youth being 2.2 times more likely to have taken an HIV test within the past 6 months.⁷⁵



Health Care

AI algorithms are already augmenting human experts in interpreting x-rays, detecting diseases and cancers and suggesting more finely-tuned treatments. Mammograms can be reviewed and translated 30 times faster with 99 percent accuracy, reducing the need for unnecessary biopsies and increasing the chances of early detection.⁷⁹ AI applications could save \$150 billion annually for the United States health care economy by 2026.⁸⁰



Senior Citizens



AI systems can detect when an elderly person falls and may alleviate caregiver shortages for seniors with dementia, Alzheimer's disease and depression.⁷⁶ An AI-programmed robot developed at the University

of Denver can hold conversations with patients, offer medication reminders and lead light physical activity and cognitive games.⁷⁷ By 2030, one in five Americans will be of retirement age; in California, the number of adults 65 years or older is projected to increase by nearly 60 percent between 2017 and 2030.⁷⁸

Persons with Disabilities



AI systems that understand images, sounds and languages can support people with deafness and autism.⁸¹

What Risks Does an AI World Bring?

Artificial intelligence can offer significant quality of life improvements, but the risks and benefits of this technology may not be evenly distributed across society. AI systems may incorrectly label women as worse hires than men. Workers in low-skill occupations may find their jobs replaced by a machine. If not properly addressed, artificial intelligence can widen inequality and violate human rights. This section discusses the legal, social and economic risks an AI world could bring.

Bias and Discrimination: Isn't This Only a Human Problem?

Machine Bias and How it Can Lead to Unlawful Discrimination. Artificial intelligence empowers machines to think like people. However, machines that utilize artificial intelligence are prone to incorporating the biases contained in data and of their human engineers. Machine bias occurs when different groups of people are treated unequally by machines on the basis of their gender, race and other characteristics.⁸² For example, an AI algorithm that is taught to diagnose skin cancer using images of white faces means the system will perform best for Caucasians as opposed to African-Americans.⁸³ Machine bias could lead, whether intentionally or unintentionally, to unequal and unfair treatment for certain socio-economic, racial, religious and other similar groups. It may identify people of color as being at higher risk for committing a crime or systematically exclude people with mental disabilities from being hired.⁸⁴ Machine bias may perpetuate discriminatory outcomes and prevent society from gaining the benefits of AI-powered technology.

The Ways Machine Bias is Created. Data is the life blood of artificial intelligence, because to make decisions and predications AI technology uses data. Therefore, artificial intelligence is only as good as the data it receives and learns from.⁸⁵ Data, however, may be incomplete or skewed. For instance, an AI algorithm could scan historical data and conclude that white men are the most likely to succeed as CEOs, because, until very recently,

women and minority groups seldom had the opportunity to become CEOs.⁸⁶

In addition, when designing AI systems, computer engineers may pass along human prejudices, assumptions and preconceived notions inadvertently or purposely. For instance, the term “receptionist” could be linked to “female,” thus embedding a stereotype in the program.⁸⁷ An algorithm to assess loan applicants may be designed to consider both income levels and past repayments with heavier emphasis on income. Slanting the algorithm in this way, while even seemingly justified, may discriminate against people who tend to be in lower-income brackets, such as women.⁸⁸

Machine bias can emerge because AI researchers, engineers and developers are mostly male, generally highly paid and technically educated. Their interests, perspectives and life experiences are naturally reflected in the technology they create and advance.⁸⁹ Theirs, however, is not the only world view. Absent a rich diversity among AI innovators, the technology could fail to achieve the economic, social and environmental benefits it otherwise could, and, worst case scenario, AI could end up causing more harm than good.⁹⁰

“I want to see stories about people getting hired at 55 or in their late 40s. I don't see enough of that in Silicon Valley.”⁹¹

Foaad Khosmood, senior research fellow, Institute for Advanced Technology and Public Policy

The Implications of Machine Bias. Racial discrimination can live on AI platforms.⁹² A 2016 ProPublica investigation into Florida's criminal justice system found racial bias within an AI algorithm used to assess the risk of recidivism. The algorithm, known as the Correctional Offender Management Profiling for Alternative Sanctions (COMPAS), was twice as likely to flag black defendants

mistakenly as being at higher risk to commit future crimes. COMPAS was also twice as likely to flag white defendants incorrectly as low risk re-offenders.⁹³ COMPAS is used by the California Department of Corrections and Rehabilitation and the Board of Parole Hearings. ProPublica, however, did not evaluate California's use of the system.⁹⁴

Machine bias could also amplify harmful stereotypes. Examples include a camera that cautioned against taking the picture of a Taiwanese-American, because the software erroneously believed she was blinking.⁹⁵ Google's image labeling technology resulted in racist miscategorizations of two black people.⁹⁶ AI algorithms do not require explicit data on race, gender or socioeconomic status to exhibit bias. Commercial lending and insurance algorithms, for example, may not ask direct questions about race or class identity, but these tools frequently incorporate other variables like ZIP code that would count against those living in poor communities.⁹⁷ AI systems might not work well for all populations and can reflect prejudices deeply embedded in history and society.

Actions by Private Industry to Avoid Machine Bias. State and federal governments collect and possess immense data sets, including demographics, housing, migration, transportation, economics and retail. Representatives from technology companies have been lobbying state and federal governments to release more government-collected data, arguing that to minimize and avoid bias in AI applications the use of broader and more reliable data sets is needed.⁹⁸ Otherwise, there is a risk that AI applications will have an overreliance on data collected from social media and apps. Data mined from such limited sources may result in lopsided benefits for socioeconomically advantaged populations, since those tend to have greater access to such devices and services.⁹⁹

Where AI applications are used to replace human decision making, many experts advocate for increased transparency in the design of AI algorithms in order to determine and understand whether the basis of the decision was fair, objective evidence-based and well-reasoned.¹⁰⁰ As machines continue to help with decision making, some researchers have emphasized the importance of developing explainable AI. The goal of explainable AI is to ensure that machines can accurately

explain a decision, prediction or forecast in ways humans can understand.¹⁰¹

Ryan Harkins, director of state affairs and public policy at Microsoft, told Commissioners that computer programmers can reveal the conclusions determined by algorithms used by AI machines, but they cannot always explain how the judgment of the machine is shaped. To encourage transparency, the government could protect the propriety rights of companies that publically share the assumptions contained within the data and algorithms used by AI machines. In addition, the information required to be disclosed could include target variables and intended outcomes, such as whether a loan applicant has credit worthiness.¹⁰²

Privacy: Does Machine Learning Have a Nosy Side?

Users of AI systems may not fully understand how AI technology can potentially, and perhaps unintentionally, intrude into areas of their life they believed were private. A woman in Oregon recently discovered that her Amazon Alexa had recorded a conversation between her and her husband without their permission or awareness. Alexa sent the audio recording to a random person on their contact list. Amazon later acknowledged the incident, but maintained that Alexa had been given verbal instructions to send the recording.¹⁰³

In 2015, Google's AI subsidiary, DeepMind, was found to have violated the data privacy laws within the United Kingdom. While developing a health care app, DeepMind acquired large amounts of sensitive public health data from United Kingdom hospitals, but patients were not asked if they consented to having their medical data processed by DeepMind.¹⁰⁴

Users of social media may not be aware of how law enforcement can use AI to track their social media usage and draw conclusions, correct or incorrect, about them. At a recent Assembly Joint Informational Hearing, Matt Cagle, a technology and civil liberties attorney for the American Civil Liberties Union, described how automated, social media surveillance software employed by California law enforcement agencies led to discriminatory targeting. Fresno police used a product called Beware that assigned color threat levels to residents based on their social media posts and other commercial records.

“There is a lot to be gained by just having people walk through the potential unintended consequences (of AI-powered technology).”¹⁰⁶

Jennifer King, director of consumer privacy, Stanford University Center for Internet and Society

Law enforcement in San Jose used social media surveillance to oversee Asian, Muslim and Sikh protestors. Mr. Cagle warned that these types of AI systems could be used to monitor and deport immigrant communities. He emphasized the need for greater transparency, accountability and oversight.¹⁰⁵

Private Industry Seeks a National Framework to Avoid Privacy Concerns.

Private companies are lobbying federal officials to

adopt a new national privacy law. The law would replace California’s privacy standards with rules that would give private companies greater leeway over how personal digital information is handled. While other specifics of the proposal are unclear, the primary goal is to create a single national framework for protecting sensitive data.¹⁰⁷

Facial Recognition: Can You Control Who Uses Your Face?

Facial recognition utilizes images and algorithms to ascertain or verify the identity of an individual. A facial recognition system measures the distinctive facial features in an image, transforms that information into algorithms representing that person’s face and compares that to other faces already in the system’s repository. Uses of facial recognition span various industries and

impact aspects of human life in both innocuous and substantial ways. Facebook applies facial recognition to suggest how to tag photos, and Apple allows a user to unlock their phone by verifying the user’s face. Smart TV’s and advertising firms use facial recognition to learn how to target consumers with specified products for future consumption. Through facial recognition, churches can track membership attendance and retailers can spot shoplifters entering a store.

Despite its broad use, there is no national policy regarding facial recognition.¹⁰⁸ Several efforts at the federal level have led to mixed results. In 2014, the Department of Commerce’s National Telecommunication and Information Administration led stakeholder meetings regarding industry uses of facial recognition with the aim of creating voluntary privacy standards to protect consumers. The meetings brought industry and consumer privacy advocates together. Although the group issued a best practices document, privacy advocates dropped out of the meetings due to disagreement over what constitutes adequate protections.¹⁰⁹ A 2012 Federal Trade Commission (FTC) staff report included recommendations that private industry design software using facial recognition with consumer privacy in mind, develop reasonable security protections for collected information and ensure sound methods for keeping and destroying collected information.¹¹⁰

Mired with controversy over the use of its facial recognition system for surveillance by law enforcement, Amazon in July 2018 weighed in on government’s role in regulating the technology. After explaining that all of Amazon’s customers agree not to engage in illegal activity, the company stated that, “It is a very reasonable idea, however, for the government to weigh in and specify what temperature (or confidence levels) it wants law enforcement agencies to meet to assist in their public safety work.”¹¹¹

Illinois, Texas and Washington are the only states with laws on facial recognition that limit its use to a certain degree.¹¹² Facebook’s tag feature is currently the subject of a lawsuit in Illinois based on the state’s Biometric Information Privacy Act. The law protects against the use of facial technology without informed consent by the consumer. The case will decide whether a user’s acceptance of Facebook’s terms and conditions signifies consent.¹¹³ Local governments have moved toward

To minimize machine bias, the collection of demographic and socioeconomic data should be meaningful, relevant and diverse, while ensuring that sensitive data is protected against unauthorized access and disclosure. Processes for detecting, correcting or removing corrupt or inaccurate records from record sets should also be implemented.

limiting the use of facial recognition technology as it relates to surveillance.¹¹⁴

In July 2018, Microsoft's President Brad Smith penned a blog calling for government regulation of facial recognition technology. Mr. Smith issued a call for an expert bipartisan commission that could consider issues regarding facial recognition's use by law enforcement, minimum performance levels of accuracy and consent of its use.¹¹⁵

Anticipated Impacts of AI on Employment

Recent research by the global management consulting firm, McKinsey and Company, found that the primary driver of workforce transformation would be the displacement of job activities and tasks due to automation.¹¹⁶ After reviewing 800 occupations, McKinsey estimated that at least one-third of work activities could be automated in 60 percent of occupations. Collection and processing of data, and the performance of predictable physical tasks like operating machinery or preparing fast food, are tasks more likely to be replaced by automation. Jobs involving large amounts of labor, such as paralegal work and accounting could be impacted by automation, while jobs involving managing people, applying expertise or interacting socially will be less subject to automation.¹¹⁷

Although it is certain that automation and AI-based technology will change the labor market, it is less clear how and when those changes will occur. Some expert witnesses told the Commission they anticipated that new technologies would have a serious and detrimental impact on jobs while others were more optimistic. Regardless, there was general consensus that policymakers can positively influence the future of employment, but only if they take appropriate action and soon.

California: What the Data Shows and Does Not Show

The federal Bureau of Labor Statistics (BLS) publishes 10-year estimates of national employment by industry and occupation by analyzing current and historical economic data. The bureau's projections rely on a series of assumptions to create a 10-year estimation of future jobs; however, the Commission learned that BLS assumptions are not necessarily consistent with a real-world economy. The BLS model assumes there will be no changes in the future business cycle; broad social and demographic trends will continue; and the supply and demand of labor will remain in equilibrium.¹¹⁸ Though labor market information analyzed by BLS accounts for

the impact of automation on the nature of work—self-checkout machines in grocery stores or ATM machines in banks—its projections do not account for significant, long-term changes in the labor force due to smarter and smarter machines.¹¹⁹

The Employment Development Department (EDD) is the state's equivalent of BLS. The EDD publishes short-term (2-year) and long-term (10-year) regional and state labor projections to identify labor trends.¹²⁰ On an annual basis, EDD submits statistical reports to BLS. While BLS does not have stringent methodology requirements for the reports, EDD uses BLS software, and thus BLS methodology and assumptions, for the reports. Accordingly, EDD's analysis of data and forecasts of economic trends are intertwined with the arguably faulty presumptions embedded in the BLS system. That problem alone is cause for worry, but there is more. EDD gathers some of its data from voluntary employer surveys; yet, many tech firms decline to respond. This lack of participation means that EDD's projections for future labor force needs may be inaccurate.¹²¹

There is not a separate unit within EDD that conducts data analysis or produces reports on why certain occupations in California have changed.¹²² It should be noted the employment security department in the state of Washington designed its own economic modeling instead of using the prepackaged BLS software. The department strives to use methodology that will best capture labor trends contained within specific industries, while still meeting BLS reporting requirements.¹²³

Labor Markets: California May Find Clues There

To date, much attention has been given to the threat of job losses stemming from an increase in automation and other AI-based technologies. A 2013 study out of Oxford University predicted about 47 percent of U.S. employment is at risk due to these technologies.¹²⁴

Software entrepreneur and author of *Rise of the Robots*, Martin Ford predicts a jobless future where machines take over more and more of the tasks that comprise typical jobs.¹²⁵ Microsoft co-founder Bill Gates believes job loss will be devastating and suggests a robot tax to modulate the impact.¹²⁶ Elon Musk, CEO of Tesla, mirrors those concerns and advocates for a universal basic income.¹²⁷

Yet, many experts predict moderate job loss. The Information Technology and Innovation Foundation estimates that about eight percent of jobs are at high risk of automation by 2024.¹²⁸ A 2017 study by McKinsey and Company estimated that automation could result in the loss of 39 million jobs and displacement of approximately 23 percent of workers in the United States by 2030.¹²⁹ In addition, the Information Technology and Innovation Foundation contends that the 2013 study by the University of Oxford is flawed and said it is “alarmist” to believe the world’s economies face a tsunami of job destruction.¹³⁰ *Governing Magazine* noted in 2017 that “the biggest unknown at this point is whether automation will eliminate more jobs than it creates.”¹³¹

Some economists believe that technological innovations will create more jobs. They point to historical examples of new technologies that increased the demand for workers to focus on tasks that machines could not. An often cited example is the advent of the ATM machine, which performs routine banking tasks for customers, thus permitting bank tellers to provide other, less routine, banking services to customers. An economist at the Boston University School of Law found that between 1982 and 2012 employment grew faster in occupations that made more use of computers, thus allowing employees to focus on other aspects of their work.¹³³ McKinsey predicts that new occupations will be created as a consequence

“Today we are in the midst of just such a panic cycle about artificial intelligence (AI) , and much of the panic swirls around its potential impact on jobs, inequality and other economic outcomes.”¹³²

Robert Atkinson,
president, Information
Technology and
Innovation Foundation

of demographic and policy demands, which may help to counterbalance job displacement. For example, investments in renewable energy and mitigation of climate change may create demand for workers across several sectors, from manufacturing and construction to installation. Similarly, growth in the population of people age 65 and older may create demand for occupations in the health care sector, including doctors, nurses, home health aides and nursing assistants.¹³⁴

As new AI technologies proliferate the workplace, it is likely that more people will find themselves working alongside smart machines. Robots are transforming a number of industries, particularly in industrial settings.¹³⁵ Cobots, or collaborative machines that work alongside human operators, are able to perform specific routine tasks, thus freeing up employees to perform more sophisticated work.¹³⁶ Some predict that demand for cobots will increase in industries facing employee retirements, like agriculture, manufacturing and construction.¹³⁷

Some economists, though, are sounding warning alarms for wages. They predict that technology-driven labor market changes will hollow out the middle class, eliminating middle-class jobs such as bookkeeping, clerical work and production. The consequence will be job polarization where, on one end, there is an increase in demand for lower-paid, low-skill jobs and, on the other end, an increase in demand for higher-paid, high-skill jobs aided by computers.¹³⁸ These economists argue that job polarization is already happening and has led to the stagnation of median wages.¹³⁹

What the Commission Heard: Optimism and Concern

In his written testimony to the Commission, Robert Atkinson, president of the Information Technology and Innovation Foundation, provided several examples of how states can and should do a better job of enabling workers to get “better” skills. States can partner with nonprofit organizations to establish better online portals for access to skill assessments, training resources and job search, such as the Council for Adult and Experiential Learning (CAEL). California also can actively and clearly notify workers once they apply for unemployment insurance that they qualify for unemployment insurance benefits

if they are in approved training. “When worker skills are more developed, worker adjustment from dislocation becomes easier,” Mr. Atkinson wrote.¹⁴⁰

At the Commission’s May 2018 advisory meeting, several labor representatives from the California Nurses Association, Teamsters, United Food and Commercial Workers (UFCW) and Service Employees International Union (SEIU) California discussed the potential negative impacts of AI-powered technology. For example, Tia Orr, SEIU director of government affairs, discussed the failed launch of a new Medi-Cal eligibility system, which was designed to automate enrollment for beneficiaries. On the first night of rollout, the system crashed and humans were needed to intervene and contact customers. “There is no incentive right now for good acting,” Ms. Orr said. “There does have to be a conversation on what we’re willing to automate. We have to ask ourselves: at what point do we bring in the human?”¹⁴¹

Annette Bernhardt, director of the low-wage work program, U.C. Berkeley Center for Labor Research and Education, told Commissioners that wages, benefits, and hours worked all may be impacted by the adoption of AI technologies. Specifically, she testified that “workers of color, immigrant workers, and women are dependent upon the type of routine/manual occupations that are at high risk of automation, or at risk of significant upskilling (requiring more education) or deskilling (resulting in lower wages).” New technologies are likely to have significant effects on the distribution of jobs by race, gender, immigration status, education level, and geography, Ms. Bernhardt said.¹⁴²

California labor representatives are concerned that job displacement due to automation and other AI technologies may exacerbate income inequality.¹⁴³ “We really need to look at the quality of jobs,” California Labor Federation Policy Coordinator Sara Flocks told legislators in a March 2018 hearing on the promises and challenges of AI for California. “We see this [problem of inequality] when you get rid of a UPS trucking job or you automate a trucker’s job and then they go be an Amazon gig worker. You’re going to take a good union job and all of a sudden it’s a low-wage, temporary, part-time, seasonal job. We’re not going to be able to rebuild our middle class with that.”¹⁴⁴

Ms. Bernhardt told Commissioners policymakers now have a range of options to shape the speed, direction and scope of transformation. She points out that technical feasibility of automation is not the same as adoption and implementation of new technologies. “A wide range of factors (economic, social, political, organizational) drive the scope and pace of technology adoption, which is often slower and less complete than one would predict based on feasibility alone,” she testified at the Commission’s January 2018 hearing. “The lesson from past technological transformation is that public policy plays a significant role in determining the trajectory of adoption and impact.” She concluded that large-scale automation may not occur in the United States in the near or medium term, especially if public policy prioritizes investments that support economic growth, innovation, job quality and workforce transition.¹⁴⁵ Ms. Bernhardt also told the Commission:

All of the attention to date has been on automation. But new technologies have many other direct effects on tasks—deskilling or upskilling existing ones, creating new ones—as well as a slew of indirect effects, such as enabling outsourcing and changing the job matching process. These are all important effects for policymakers to understand. In particular, it is likely that incremental changes in task content and skill requirements will affect more workers in the coming years than large-scale automation events.¹⁴⁶

“Some workers will have to be retrained to work alongside AI directed machines, while others will have to be redeployed within the company or elsewhere in the economy; businesses have a vital role to play in aiding these transitions. This will require changes in skills, mindsets and culture as we transition into a world where ‘coworkers’ include machines as well as other people.”¹⁴⁷

McKinsey Global Institute

The Real Story on AI's Impact: There is Disagreement, Except on the Need for Policy Action

As discussed above, there is no consensus on *how* and *when* automation and, in particular AI technology and applications, will change the workforce. There is also disagreement on what that change will look like.

This disagreement may be best demonstrated in discussions concerning driverless cars. Researchers with the Economic Policy Institute contend that there is no proof automation has caused wage inequality or stagnation and dispute its impact on overall joblessness. Instead of making workers obsolete, they believe “rapid technological advances are associated with better, not worse, economic outcomes for working Americans.”¹⁴⁸

Most recently, a September 2018 report from the U.C. Berkeley Center for Labor Research and Education and Working Partnerships U.S.A. explored how self-driving technology could transform the trucking industry. Researchers predicted autonomous trucks could replace as many as 294,000 non-specialized long-distance drivers, eliminating both some of the highest-paid career trucking positions and many more moderate-wage driving jobs.

Those researchers, however, also predicted that automation could create many new driving jobs that require humans to navigate local streets and handle non-driving tasks. Local and delivery drivers currently receive low wages and often have poor working conditions. The U.C. Berkeley researchers envisioned a new scenario where autonomous trucks could almost constantly be on the highway and human drivers could work locally and go home each night. This strategy could save the trucking industry billions each year.

The U.C. Berkeley researchers found that proactive public policy is needed to ensure that the benefits of automation are spread in the transportation industry. They suggest policymakers could design job-quality standards to ensure living wages and good working conditions for drivers and create regulations to incentivize clean trucks to reduce pollution and other environmental and public health costs.¹⁴⁹ Of course, those are only suggestions that may never occur without lawmakers taking action.

“The question is: can we actually transition people from what they’re doing now to what they will need to do in the future. This will affect all of us. All of us will have a significant number of activities that machines will be able to do. Then the question is not about mass unemployment but mass redeployment.”¹⁵⁰

Michael Chui, partner, McKinsey Global Institute

Are Californians Being Prepared for an AI World?

California has three public university systems: the community colleges, state universities and the University of California. The Master Plan for higher education in California, which was originally adopted in 1960, provides in relevant part that the community colleges will offer lower-division instruction that is transferable to four-year colleges, provide remedial and vocational training and grant associate degrees and certificates. The University of California is to serve as the state's primary public research university and grant baccalaureate, master's, doctoral and other professional degrees. The California State University (CSU) is to focus on instruction in the liberal arts and sciences and grant baccalaureate and master's degrees. Subsequent legislation, however, has permitted CSU to offer doctorates under limited circumstances.¹⁵¹

In addition, Senate Bill 850 (Block), which was approved into law in September 2014, established a statewide baccalaureate degree pilot program at not more than 15 community college districts with one baccalaureate degree program each, to be determined by the Chancellor and approved by the Board of Governors.¹⁵² Participating community college districts must meet specified requirements, including, but not limited to, offering baccalaureate degree programs and program curricula not offered by the California State University or the University of California, and in subject areas with unmet workforce needs, as identified and documented by the district. The law by its own terms becomes inoperative on July 1, 2023.¹⁵³

In 2016, the University of California, Berkeley opened the Center for Human-Compatible Artificial Intelligence.¹⁵⁴ The primary focus of the new center is to ensure that AI systems are beneficial to humans.¹⁵⁵ In 2016, the University of Southern California, a private school, created the Center on Artificial Intelligence for Society or CAIS. Milind Tambe, the co-director of the center, said, "Wicked social problems such as homelessness are incredibly complicated. AI provides us the opportunity

to address them in new ways and yet provide concrete strategies for tackling these problems."¹⁵⁶

While the California Community College System (CCCS) has colleges that offer computer science associate degrees, none are specific to artificial intelligence. In addition, the CCCS does not have any program similar or equivalent to CAIS or the Center for Human-Compatible Artificial Intelligence. The California Department of Education has adopted the state's first-ever computer science standards for K-12 grades, and those standards include instructional content related to artificial intelligence for grades 9 through 12.

The California Department of Technology offers a nine-week training program for state employees working in the information technology field that includes such topics as data analytics and representation. In addition, the Governor's Office of Business and Economic Development (GO-Biz) sponsors a cyber-challenge event that provides cybersecurity education and training for young people, but there is no event specific to artificial intelligence.

The Bureau of Labor Statistics (BLS) estimates that the number of computer and information research science positions will increase by 19 percent between 2016 and 2026.¹⁵⁷ The California job market for computer and information research scientists is projected to increase by 22 percent between 2016 and 2026.¹⁵⁸

California Community Colleges

The CCCS is a postsecondary education system and includes the Board of Governors of the California Community Colleges, the Chancellor’s Office, 72 community college districts and 114 community colleges.¹⁵⁹ The CCCS serves more than 2.1 million students. A seventeen-member Board of Governors, appointed by the California Governor, oversees CCCS.¹⁶⁰ The board exercises general supervision over the system of community colleges and provides leadership and direction through planning and policymaking.¹⁶¹ The Consultation Council, which is comprised of 18 representatives from stakeholder groups such as trustees, students, administrators and business officers, meets once per month to review and evaluate policy proposals and related issues impacting the CCCS.¹⁶²

An important component to the CCCS success is alternative methods of instruction, such as distance learning. “Many districts are actively pursuing online courses as a method of instruction in order to provide greater access for students as well as reducing the need for new facilities.” In the 2016-17 school year, there were 164,855 full-time equivalent students who took distance education, which is 14 percent of the total full-time equivalent students (1,183,240).¹⁶³

Most, if not all, community colleges offer a degree or certificate related to computer science, but there are some 50 subcategories related to computer science, ranging from programming to helpdesk support.¹⁶⁴ The College of Marin and Butte College, for instance, offer associate degrees in computer science. Both programs prepare students for fields as software or hardware programmers.¹⁶⁵ Associate degrees specific to technologies driven by artificial intelligence are not offered, however, in the CCCS. In addition, CCCS does not have any program equivalent to CAIS or the Center for Human-Compatible Artificial Intelligence. In fact, a search on the California Community Colleges website for “artificial intelligence” revealed no results.¹⁶⁶

The 2019-20 Five-Year Capital Outlay Plan states, in relevant part, “[D]ue to technological advances, California Community Colleges needs to incorporate more sophisticated technology into its facilities so the system can deliver state-of-the-art instructional programs. To make buildings smarter by providing cabling and

deliverance systems to the instructional space, major renovations will be required.” The five-year plan includes 23.6 million assignable square feet to be modernized over the next five years at a cost of \$11.5 billion and relates only to buildings more than 40 years old and reported as needing major renovation.¹⁶⁷

7,081,091 assignable square feet is needed at a cost of \$10.9 billion to accommodate current and future enrollment at CCCS. The total unmet needs and costs for facilities are \$30.4 billion.¹⁶⁸

An opportunity thus exists to expand upon the CCCS computer sciences curriculum by including classes and degrees specifically related to the development and use of artificial intelligence and applications. This addition would complement and expand upon the new computer science standards for grades K-12. Any such courses should be taught within a framework that promotes AI for economic, social and environmental good.

The Strong Workforce Program

In 2016, Assembly Bill 1602 (Committee on Budget) created the Strong Workforce Program, which expands and improves career education, also known as career technical education or CTE, throughout the state with the CCCS leading the effort.¹⁶⁹ Year one served in large part as an implementation year, with colleges and regions planning, preparing and collaborating to begin laying the foundation for “more and better” career education programs. The CCCS activities in the first year were many and included: increased collaboration and visibility of career education programs, and greater focus on programmatic decision-making. For year two, the CCCS recommends continuing the development of regional structures, strengthening connections to partners and promoting the use of data for community college leadership, administration and faculty to better understand the areas in which they are succeeding and where they need improvement related to student outcomes.¹⁷⁰

The state's Economic and Workforce Development (EWD) Program supports the Strong Workforce Program by furnishing education, training and other services that advance the economic growth and global competitiveness of California and its regional economies. By providing grant awards, EWD provides the financial support needed for the workforce development of employers, workers and students. The majority of grants go to the "ecosystem of intrapreneurs" who are sector experts and navigators working to build or strengthen business and industry links with community colleges to ensure that community college programs move and form at the speed and need of business and industry.¹⁷¹

The Strong Workforce Program investments for year one show that in 2016-17 funds were invested in a variety of sectors across the seven macro-regions. The seven macro-regions were: Bay Area, Central/Mother Lode, Inland Empire/Desert, Los Angeles/Orange County, North/Far North, San Diego/Imperial and South Central Coast. The sectors included advanced manufacturing, advanced transportation and renewables, agriculture, water and environmental technologies, clean energy (Proposition 39), education, health, global trade and logistics and public safety. Technologies in those sectors that use artificial intelligence were not expressly identified.¹⁷² Accordingly, this gap presents an opportunity for lawmakers to ensure that the Strong Workforce Program is inclusive of businesses that develop and/or use AI technology and applications.

California's First-Ever Computer Science Standards

The State Board of Education (SBE) is required to adopt statewide academically rigorous content standards, pursuant to recommendations of the Commission for the Establishment of Academic Content and Performance Standards, in core curriculum areas. On September 30, 2014, Governor Brown signed Assembly Bill 1539 (Hagman) into law, which required the California Department of Education (CDE), Instructional Quality Commission (IQC), on or before July 31, 2019, to "consider existing computer science content standards, which include, but are not limited to, the national K-12 computer science content standards developed by the Computer Science Teachers Association, and consider content standards that include, but are not necessarily limited to, standards for teaching coding."¹⁷³ Coding is

defined as "the process of converting a program design into an accurate and detailed representation of that program in a suitable language."¹⁷⁴ The operation of the law is subject to an appropriation in the annual Budget Act or another statute.¹⁷⁵

In September 2016, the SBE began the process of implementing this law into standards, and, on July 26, 2018, the IQC and SSPI recommended to the SBE a draft of the Computer Science Standards.¹⁷⁶ On September 7, 2018, the SBE approved the standards, which are California's first ever computer science standards.¹⁷⁷ The proposed standards include the goal that second graders will learn to use common computer hardware and software and be able to create simple computer programs and debug errors in an algorithm. The standards for high school include more complicated coding and data analysis.¹⁷⁸

For grades 9 through 12, the draft standards include standards related to describing how artificial intelligence drives many software and physical systems. The following is the descriptive statement for the standard:

Artificial intelligence is a sub-discipline of computer science that enables computers to solve problems previously handled by biological systems. There are many applications of artificial intelligence, including computer vision and speech recognition. Students research and explain how artificial intelligence has been employed in a given system. Students are not expected to implement an artificially intelligent system in order to meet this standard.

For example, students could observe an artificially intelligent system and notice where its behavior is not human-like, such as when a character in a videogame makes a mistake that a human is unlikely to make, or when a computer easily beats even the best human players at a given game.

Alternatively, students could interact with a search engine asking various questions, and after reading articles on the topic, they could explain how the computer is able to respond to queries.¹⁷⁹

The draft also includes standards related to the implementation of algorithms that use artificial intelligence to overcome simple challenges. The descriptive statement provides:

Artificial intelligence algorithms allow a computer to perceive and move in the world, use knowledge, and engage in problem solving. Students create a computational artifact that is able to carry out a simple task commonly performed by living organisms. Students do not need to realistically simulate human behavior or solve a complex problem in order to meet this standard.

For example, students could implement an algorithm for playing tic-tac-toe that would select an appropriate location for the next move.

Alternatively, students could implement an algorithm that allows a solar-powered robot to move to a sunny location when its batteries are low.¹⁸⁰

The computer-science standards are primarily technical in nature and do not include courses on ethical considerations related to the development and use of AI or how AI can, and should, be used for economic, social and environmental good.¹⁸¹ This is an educational gap that should be remedied in future legislation.

Other states have folded computer science into the K-12 curriculum, including Ohio, Virginia, Utah and Wisconsin. Virginia was the first.¹⁸²

The California Computer Science Strategic Implementation Plan Panel

The California Computer Science Strategic Implementation Plan Panel, which is within the CDE, is recommending the state adopt a high school graduation requirement and a teacher certification pathway for computer science, and that it expand scholarship eligibility and loan forgiveness for computer science teachers in low-income districts. The Department of Education is expected to turn those recommendations into an implementation plan, which the board is scheduled to consider for adoption in March 2019.¹⁸³

State Government

California Department of Technology. The California Department of Technology (CDT) offers a nine-week program, called the Digital Services Innovation Academy (DSIA), for state employees working in the information technology field. The course is designed to introduce students to the tools and skills required to transform a business problem from concept to product using design and development principles found in modern digital service development. Topics include data analytics and representation, UI/UX design, development methods, ideation and communication. Students also do a digital services challenge assignment that provides them the opportunity to apply the concepts and knowledge they have learned during the academy. The curriculum, however, does not expressly address the use or implementation of technologies driven by artificial intelligence.¹⁸⁴

The Governor's Office of Business and Economic Development. The effects of emerging technologies on the labor market require businesses and government to consider how to prepare the next generation of workers. The Governor's Office of Business and Economic Development (GO-Biz) sponsors the California Cyber Innovation Challenge (CCIC) as part of an effort to prepare young people for the needs of future jobs involving cybersecurity. The CCIC is a statewide competition for high school students allowing them to demonstrate their skills and learn about careers in cybersecurity.¹⁸⁵

Students reached the CCIC via an at-large application process or through their success at regional competitions taking place in Los Angeles, Sacramento, San Diego and the Bay Area. The number of teams in the CCIC has grown each year from eight to 20, comprised of up to five students each. The CCIC includes timed cybersecurity challenges intended to replicate real world scenarios.

The CCIC received financial support from the California Workforce Development Board and relied on partnerships with the California Community Colleges Chancellor's Office, the Governor's Office of Emergency Services, the Department of Technology, the California Military Department and the California Department of Justice.¹⁸⁶ GO-Biz also teamed up with the CyberCalifornia Coalition—made up of businesses, academic institutions and state agencies—since the competition's inception in 2016. Among its various goals, CyberCalifornia strives to strengthen the state's leadership in cybersecurity and connect the state's workforce development system with the needs of employers.¹⁸⁷ GO-Biz also collaborates with institutions of higher learning to serve as hosts, which thus far have included Sacramento City College and California Polytechnic State University.

The CCIC represents how industry, government and academia can work together to encourage the workforce of the future to enter careers in emerging technologies. The competition exposes young students to critical training that will help meet the demands of the changing labor market.

Are California State Agencies Preparing for AI?

In March 2018 lawmakers held two informational hearings to consider how artificial intelligence technologies may change California’s economic and social landscape. The first focused on automation applications in government and other settings, and included discussions around balancing convenience, bias and privacy, as well as implications of AI on the workforce and public policy.¹⁸⁸ The second focused on ways technology and automation may impact worker rights and job quality.¹⁸⁹

In July 2018, the Little Hoover Commission surveyed representatives from 84 California state agencies about the applications and implications of artificial intelligence in their organizations. The Commission received 25 responses. The majority of survey respondents (80 percent) reported that their department is not currently using AI, although nearly 23 percent said their department intends to use AI within the next decade. Several said their department is currently using technology to automate tasks. The Public Employment Relations Board uses AI technology to automatically process templates for notification, the Office of Administrative Law uses it to calendar due dates of assignments based on statutory requirements and the Office of the Secretary of State uses it to operate a chatbot, a program built to automatically engage with received messages.



The California Department of Corrections and Rehabilitation and the Board of Parole Hearings, although not responding to the survey, use AI technology to operate the Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) tool to determine if an inmate should be paroled.¹⁹⁰



GO-Biz works with 15 regional innovation hubs across the state to stimulate partnerships, economic development and job creation around specific research clusters, including AI.¹⁹¹ Part of the office’s role is to bring industry entrepreneurs to Sacramento to meet with state regulators and lawmakers to help inform policy decisions around the opportunities of using new technologies.

“We want to hear from the private sector about how we can help pioneers be successful.”¹⁹²

Sid Voorakkara, deputy director of external affairs, Governor’s Office of Business and Economic Development

The Department of Technology is beginning to consider ways AI can make it easier for citizens to communicate with government and conduct online research by, for instance, embedding AI chatbots on CA.gov websites and expanding the department’s open data platform.¹⁹³



The Department of Food and Agriculture is involved in burgeoning efforts led by the University of California Agricultural and Natural Resources to use a broad range of agricultural technology to solve some of the major agricultural challenges facing the state, including climate change, drought and invasive species.

The February 2018 California Public Sector CIO Academy sponsored by Government Technology featured a panel discussion on intelligent and cognitive automation, including how government technology leaders can incorporate a range of solutions into their work, from simple bots to complex machine learning.¹⁹⁴

Are Lawmakers Preparing for AI?

During the 2017-2018 session, Assemblymember Kiley, with several co-authors, introduced Assembly Concurrent Resolution 215. This measure passed both Houses and was filed with the Secretary of State on September 7, 2018. It expressed the support of the Legislature for the 23 Asilomar AI Principles, as guiding values for the development of artificial intelligence and of related public policy. These principles were developed by leading AI researchers, economists, legal scholars, ethicists and philosophers during a conference hosted by the Future of Life Institute. Over 1,200 AI and robotics researchers signed the principles, which are intended to promote the safe and beneficial development of artificial intelligence.¹⁹⁵

Senate Bill 1470 (Stern) would establish the Commission on the Future of Work, which would consist of eight members with knowledge of, and expertise in, the following areas: work, workforce development, labor, technology, robotics or artificial intelligence. The bill was held in the Assembly Appropriations Committee.

Assembly Bill 2596 (Cooley) would declare that California needs a “triple-bottom-line” strategy that simultaneously advances an inclusive economy through equity, prosperity and sustainability while responding to market forces by, among other things, encouraging the development within California of new technologies that yield more equitable, efficient, sustainable communities and affordable qualities of life. The bill was vetoed by Governor Brown on September 25, 2018. In his veto message, Governor Brown stated, “I don’t believe an ongoing costly study and report will provide any additional benefit to these efforts.”

On June 28, 2018, Assembly Bill 375 (Chau) was approved by the Governor and filed with the Secretary of State. This bill declares, in relevant part, that people desire privacy and more control over their information and they should be able to exercise control over their personal information. Beginning January 1, 2020, the bill will grant consumers the right to request a business to disclose the following: (1) the categories and specific pieces of

personal information that the business collects about the consumer; (2) the categories of sources from which the information is collected; (3) the purposes for collecting or selling the information; and (4) the categories of third parties that have received the information.

Governor Brown’s 2018-2019 budget did not expressly reference the impact AI-powered technologies will have on the economy and jobs, but the budget establishes tax credits, and training and education programs that provide opportunities for Californians to transition smoothly into an evolving labor market where smarter and smarter machines will exist. The budget expanded California’s Earned Income Tax Credit to cover individuals who are between ages 18 and 24 and over age 65. The income level at which the credit phases out completely was increased to \$24,960.

The budget included a \$120 million allocation to create an online community college to provide vocational training, career advancement and credentialing opportunities to fill current workforce gaps. In addition, \$150 million was assigned to build K-12 career technical education classes as part of the Strong Workforce Program. The California Education Learning Lab was established to increase learning outcomes and close achievement gaps through adaptive learning technologies in scientific, technology, engineering and math (STEM) classes.

The California Apprenticeship Initiative New and Innovative Grant Program, also created by Governor Brown’s budget, funds opportunities in developing industry areas, such as advanced manufacturing, where apprenticeships are either non-existent or not fully established. The budget allocated additional grant funding for public private partnerships to prepare students for high skilled STEM careers and for the development of online programs that lead to short-term, industry-valued certificates by community college districts.

Resources

Top Reports

1. Council of Economic Advisers, July 2018, Addressing America's Reskilling Challenge. This white paper emphasizes the importance of collaborations between employers, workers and educational institutions to address America's reskilling challenges.
2. Executive Office of the President, October 2016, Preparing for the Future of Artificial Intelligence. This report surveys the current state of AI, its existing and potential applications and the questions that progress in AI will raise for society and public policy. It also recommends specific actions, including collaboration, development of best practices in AI and retraining.
3. Gallup Inc., January 2018, Optimism and Anxiety: Views on the Impact of Artificial Intelligence and Higher Education Response. This paper describes key findings from an AI survey. The survey included questions regarding perceptions of AI's impact on people's lives and their work or education, and potential interventions from higher education, government and private industry.
4. McKinsey Global Institute, December 2017, Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation. This report summarizes previous research completed by McKinsey on the future workforce impacts of automation and AI and analyzes the factors that will lead to job loss or creation. It predicts employment growth through a series of economic models and assumptions.
5. Oxford Martin School, September 2017, The Future of Employment: How Susceptible Are Jobs To Computerisation? This report examines the expected impacts of future computerisation on U.S. labor market outcomes. It concludes that about 47 percent of total employment in the U.S. is at risk of computerisation.
6. Ryan Calo, August 2017, Artificial Intelligence Policy: A Primer and Roadmap. The paper provides a way to understand the implications of AI on services, economy and law. It raises key policy questions while underscoring the many benefits AI will bring.
7. Tata Communications, September 2018, Cognitive Diversity: AI and the Future of Work. Based on the opinions of 120 global business leaders, this report envisions a positive impact of AI on the future workplace. Business leaders believe AI will diversify human thinking, enhance human collaboration and help workers become more agile, curious and nimble.
8. Thomas Kalil, March 2017, AI for Good: Maximizing the Economic and Societal Benefits of AI. This white paper analyzes how government can set ambitious goals to ensure the responsible and beneficial development of AI. It provides specific areas where AI can achieve economic and societal benefits.
9. U.S. House of Representatives, September 2018, Rise of the Machines: Artificial Intelligence and its Growing Impact on U.S. Policy. This paper summarizes the main findings of hearings held by the Subcommittee on Information Technology of the House Committee on Oversight and Government Reform, which includes testimony from academia, industry and government.

10. World Economic Forum, September 2018, The Future of Jobs Report 2018. This report examines the implications of technological change on the future of work. The report suggests that businesses take an active role in reskilling and upskilling workers.
11. Google. AI for Social Good. This website provides various examples of how AI can solve humanitarian and environmental challenges.
12. Markle Foundation, 2018, How California's Next Governor Can Create Opportunities for Workers and Businesses. This report discusses opportunities for Californians in an automated economy.
5. Fei-Fei Li, Director, Stanford University Artificial Intelligence Lab. Ms. Li's invented ImageNet and the ImageNet Challenge, a large-scale dataset that has contributed to computer vision and deep learning in AI. She also directs the Stanford University Artificial Intelligence Lab, an academic center that builds smart algorithms.
6. Laura Tyson, Faculty Director, U.C. Berkeley Institute for Business and Social Impact. Ms. Tyson is an economist who has examined and written about domestic and international policy matters, such as the impacts of automation.
7. Lenny Mendonca, Co-Chair, California Forward. Mr. Mendonca is the co-chair of California Forward, a nonprofit organization that aims to reform policies regarding fiscal and government accountability. As a senior partner emeritus at McKinsey & Company, he founded the organization's U.S. state and local public sector practice and helped dozens of government, corporate and nonprofit clients solve their most difficult management challenges.

Top Experts

1. Annette Bernhardt, Senior Researcher, U.C. Berkeley Institute for Research on Labor and Employment. Ms. Bernhardt has collaborated with union organizations to examine the impacts of automation on jobs and studied policies to improve wages and working conditions at the local, state and national levels.
2. Jack Clark, Strategy and Communications Director, OpenAI. Mr. Clark's work focuses on setting AI policy and strategy. He frequently participates in fact-finding studies and forums related to AI and its impact on policy, ethics and security.
3. Deirdre Mulligan, Faculty Director, U.C. Berkeley Center for Law and Technology. Ms. Mulligan's researches information policy, law, privacy and security. Her work explores the legal and technical means of protecting values such as privacy, freedom of expression and fairness in emerging technical systems.
4. Eric Horvitz, Distinguished Scientist and Managing Director, Microsoft Research, Redmond. Mr. Horvitz's researches the principles and applications of machine intelligence. He also has examined how humans and machine can complement each other, creating opportunities for collaboration and enhanced productivity.
8. Olaf Groth, Program Director for Digital Futures, Hult International Business School. Mr. Groth researches AI, automation, the Internet of Things and the 4th Industrial Revolution. He has testified in front of the California State Assembly, where he emphasized the importance of governing AI so that it empowers humans.
9. Robert Atkinson, President and Founder, Information Technology and Innovation Foundation. Mr. Atkinson primarily works on issues related to technological innovation, global competitiveness and productivity growth. He has served on various federal boards and task forces, including the Commission on Workers, Communities and Economic Change in the New Economy.

10. Susan Athey, Senior Fellow, Stanford Institute for Economic Policy Research. Ms. Athey's researches the economics of the internet and digitization. She currently teaches classes about the economics of the internet and digital markets, platform markets and internet search.

6. Silicon Valley Leadership Group. The Silicon Valley Leadership Group represents more than 375 of Silicon Valley's most respected employers on issues, programs and campaigns that affect the economic health and quality of life in Silicon Valley, including tech and innovation.

7. Stanford University Center for Internet and Society (CIS). CIS brings together scholars, academics, legislators and students to study the interaction of new technologies and the law and to examine how the synergy between the two can either promote or harm public goods like free speech, innovation, or privacy.

8. TechNet. TechNet promotes the development of entrepreneurship, mobile commerce and the next wave of innovation in the new economy. The organization believes that establishing an innovation-friendly policy framework is the key to the competitiveness of the technology industry.

9. UC Berkeley Laboratory for Automation Science and Engineering (AUTOLAB). The AUTOLAB is a center for research in robotics and automation. Students pursue and work on projects related to computer assisted surgery and automated manufacturing, among other robotic applications.

10. USC Center for Artificial Intelligence in Society (CAIS). CAIS works to share ideas about how AI can be used to tackle the most difficult societal problems. The organization conducts AI research and projects that can be used to benefit low-resource communities in the United States and globally.

Top Groups

1. AI Now Institute. The AI Now Institute at New York University is an interdisciplinary research center dedicated to understanding the social implications of AI across four areas: rights and liberties, labor and automation, bias and inclusion and safety and critical infrastructure.

2. Center for Information Technology Research in the Interest of Society (CITRIS). CITRIS is sponsoring a multi-campus research initiative to explore a broad range of machine applications that can benefit people and society.

3. CompTIA. CompTIA supports the success of IT businesses across the full IT channel, from the largest vendors on one end to smaller businesses providing IT hardware, software and services on the other end.

4. Information Technology and Innovation Foundation. The Information Technology and Innovation Foundation (ITIF) focuses on issues at the intersection of technological innovation and public policy, such as innovation and competitiveness, information technology and data and trade and globalization.

5. Partnership on AI to Benefit People and Society (PAI). A non-profit organization that strives to advance the public's understanding of artificial intelligence, PAI also aims to set societal and ethical best practice for AI research.

Top Books

1. Ajay Agrawal, Joshua Gans, and Avi Goldfarb, April 2018, *Prediction Machines: The Simple Economics of Artificial Intelligence*. This book suggests how companies can set strategies, how governments can design policies and how people can plan their lives in an AI world.

2. Darrell M. West, May 2018, *The Future of Work: Robots, AI, and Automation*. This book argues that society needs to rethink the concept of jobs, reconfigure the social contract, move toward a system of lifetime learning and develop a new kind of politics that can deal with economic dislocations.
3. Erik Brynjolfsson and Andrew McAfee, January 2016, *The Second Machine Age*. This book examines how digital technology is transforming work and society. The authors recommend revamping education to prepare people for the next economy instead of the last one, designing new collaborations that pair processing power with human ingenuity and embracing policies that make sense in a radically transformed landscape.
4. John Markoff, August 2015, *Machines of Loving Grace: The Quest for Common Ground Between Humans and Robots*. This book considers: will machines help us, or will they replace us? It offers a detailed and rich history of the field of robotics and AI and emphasizes the importance of including a human element into these technologies.
5. Kai-Fu Lee, September 2018, *AI Superpowers: China, Silicon Valley, and the New World Order*. Due to unprecedented developments in AI, dramatic changes will happen sooner than many people expect. The book urges both the U.S. and China to accept and embrace the great responsibilities that come with significant technological power.
6. Mariya Yao, Adelyn Zhou, and Marlene Jia, June 2018, *Applied Artificial Intelligence: A Handbook For Business Leaders*. This book is a practical guide for business leaders to leverage machine intelligence to enhance the productivity of their organizations and the quality of life in their communities.
7. Martin Ford, July 2016, *Rise of the Robots: Technology and the Threat of a Jobless Future*. This book describes how automation is changing the economy, undermining work and reshaping lives. It examines what accelerating technology means for the economic prospects of society, now and in the future.
8. Paul R. Daugherty and H. James Wilson, March 2018, *Human + Machine: Reimagining Work in the Age of AI*. The book examines how AI is transforming all of the business processes within an organization—whether related to breakthrough innovation, everyday customer service or personal productivity habits.
9. Pedro Domingos, February 2018, *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*. This book reviews the inside the learning machines that power Google, Amazon and smartphones. It assembles a blueprint for the future universal learner—the Master Algorithm—and discusses what it will mean for business, science and society.
10. Yuval Noah Harari, September 2018, *21 Lessons for the 21st Century*. This book examines how today’s most urgent issues will evolve as technology advances faster, forcing society and policymakers to ask important questions in order to survive.

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Little Hoover Commission Members

Chairman Pedro Nava (D-Santa Barbara) Appointed to the Commission by former Speaker of the Assembly John Pérez in April 2013 and reappointed by Speaker of the Assembly Anthony Rendon in 2017. Government relations advisor. Former state Assemblymember from 2004 to 2010. Former civil litigator, deputy district attorney and member of the state Coastal Commission. Elected chair of the Commission in March 2014.

Vice Chairman Sean Varner (R-Riverside) Appointed to the Commission by Governor Edmund Brown Jr. in April 2016. and reappointed in January 2018. Managing partner at Varner & Brandt LLP where he practices as a transactional attorney focusing on mergers and acquisitions, finance, real estate and general counsel work.

David Beier (D-San Francisco) Appointed to the Commission by Governor Edmund G. Brown Jr. in June 2014 and reappointed in January 2018. Managing director of Bay City Capital. Former senior officer of Genentech and Amgen. Former counsel to the U.S. House of Representatives Committee on the Judiciary. Serves on the board of directors for the Constitution Project.

Iveta Brigis (D-Los Gatos) Appointed to the Commission by Governor Edmund G. Brown Jr. in April 2017. Lead for the open sourcing people operations program at Google Inc. since 2014 and looks after re:Work, Google's initiative to open source data-driven HR practices.

Cynthia Buiza (DTS-Los Angeles) Appointed to the Commission by Speaker of the Assembly Anthony Rendon in October 2018. Executive Director of the California Immigrant Policy Center since 2016. Former Policy and Advocacy Director for the Coalition for Humane Immigrant Rights of Los Angeles.

Senator Anthony Cannella (R-Ceres) Appointed to the Commission by the Senate Rules Committee in January 2014. Elected in November 2010 and re-elected in 2014 to represent the 12th Senate District. Represents Merced and San Benito counties and a portion of Fresno, Madera, Monterey and Stanislaus counties.

Assemblymember Chad Mayes (R-Yucca Valley) Appointed to the Commission by former Speaker of the Assembly Toni Atkins in September 2015. Elected in November 2014 to represent the 42nd Assembly District. Represents Beaumont, Hemet, La Quinta, Palm Desert, Palm Springs, San Jacinto, Twentynine Palms, Yucaipa, Yucca Valley and surrounding areas.

Don Perata (D-Orinda) Appointed to the Commission in February 2014 and reappointed in January 2015 by the Senate Rules Committee. Political consultant. Former president pro tempore of the state Senate, from 2004 to 2008. Former Assemblymember, Alameda County supervisor and high school teacher.

Assemblymember Bill Quirk (D-Hayward) Appointed to the Commission by Speaker of the Assembly Anthony Rendon in 2017. Elected in November 2012 to represent the 20th Assembly District. Represents Hayward, Union City, Castro Valley, San Lorenzo, Ashland, Cherryland, Fairview, Sunol and North Fremont.

Senator Richard Roth (D-Riverside) Appointed to the Commission by the Senate Rules Committee in February 2013. Elected in November 2012 to represent the 31st Senate District. Represents Corona, Coronita, Eastvale, El Cerrito, Highgrove, Home Gardens, Jurupa Valley, March Air Reserve Base, Mead Valley, Moreno Valley, Norco, Perris and Riverside.

Cathy Schwamberger (NPP-Calistoga) Appointed to the Commission by the Senate Rules Committee in April 2018. Associate general counsel for State Farm Mutual Automobile Insurance Company Company, where she leads State Farm's legislative and regulatory affairs in the 10 western states.

Janna Sidley (D-Los Angeles) Appointed to the Commission by Governor Edmund Brown Jr. in April 2016. General Counsel at the Port of Los Angeles since 2013. Former deputy city attorney at the Los Angeles City Attorney's Office from 2003 to 2013.

“Democracy itself is a process of change, and satisfaction and complacency are enemies of good government.”

Governor Edmund G. “Pat” Brown,
addressing the inaugural meeting of the Little Hoover Commission,
April 24, 1962, Sacramento, California