To: **Clients**
From: GoldsteinCope Policy Solutions
Date: July 12, 2018
Title: House Subcommittees on Energy and Research and Technology hearing entitled "Big Data Challenges and Advanced Computing Solutions"

I. Executive Summary:

On Thursday July 12, 2018 at 10:15am, the House Subcommittee on Energy and Subcommittee on Research and Technology held a hearing to examine the potential applications of machine learning to big data challenges to promote scientific advancement in the United States. During their opening statements, the witnesses described the challenges presented by big data and the ways in which machine learning can help scientists better understand the world. During question and answer, the representatives in attendance were particularly interested in the potential applications of machine learning technologies.

II. Member in Attendance:

Chairman Randy Weber (R-TX)
Chairwoman Comstock (R-VA)
Rep. Roger Marshall (R-KS)
Rep. Debbie Lesko (R-AZ)
Rep. Dana Rohrabacher (R-CA)
Rep. Neal Dunn (R-FL)

Ranking Member Marc Veasey (D-TX)
Rep. Suzanne Bonamici (D-OR)
Rep. Don Beyer (D-VA)
Rep. Bill Foster (D-IL)
Rep. Jerry McNerney (D-CA)
Rep. Jacky Rosen (D-NV)
Rep. Elizabeth Esty (D-CT)

III. Opening Statements:

A. Chairman Weber

Chairman Weber began his testimony describing the goal of the hearing, which was to understand how machine learning can be applied to big data challenges. Machine learning is the process by which a computer program can draw conclusions from large sets of data without being explicitly programmed for the task. Chairman Weber continued, saying that machine learning can catalyze scientific advancements and that the Department of Energy (DoE) is uniquely positioned to fund research in the field. He listed several potential applications of machine learning, including in nuclear weapons development, natural disaster response, and private industry productivity enhancements. Chairman Weber concluded his opening statement expressing his desire for Congress to help promote the advancement of machine learning in the United States and expressed his hope that the witnesses could provide Congress with ideas on how to do so.

B. Ranking Member Veasey

Ranking Member Veasey also began his testimony summarizing the myriad potential applications of machine learning algorithms applied to big data. He continued, stating that machine learning will be particularly valuable to the energy and transportation sectors. He stated that it is vital to protect the integrity and reliability of the United States' critical infrastructure, such as the power grid, and that machine learning can play a part in that protection. He concluded his opening statement expressing his desire for the witnesses to describe ways in which Congress may promote the development of machine learning technologies.

C. Chairwoman Comstock

Chairwoman Comstock described the development of machine learning, stating that even one decade ago these algorithms were only theoretical. She expressed her belief that the Department of Energy is uniquely positioned to manage the development of machine learning and described several ways in which researchers are already applying machine learning capabilities to solve scientific problems. She expressed her belief that the potential applications of artificial intelligence and machine learning are immense and could be beneficial to the United States in unimagined ways.

IV. Witness Statements:

A. Dr. Bobby Kasthuri (Researcher, Argonne National Laboratory; Assistant Professor, University of Chicago)

Dr. Kasthuri's testimony focused his testimony on his research, which uses machine learning techniques to understand and map how the human brain operates. He stated this is a pivotal time in understanding the human brain because two disciplines are coordinating their efforts: computer science and brain science. Dr. Kasthuri testified that understanding the human brain is a massive task, being that the potential amount of data derived from the human brain could be billions of gigabytes. Dr. Kasthuri stated the Department of Energy and National Laboratory System can play pivotal roles in the development brain sciences, making the mapping of the human brain a part of the public domain accessible to all U.S. researchers.

B. Dr. Katherine Yelick (Associate Laboratory Director for Computing Sciences, Lawrence Berkeley National Laboratory; Professor, University of California, Berkeley)

Dr. Yelick's testimony described large scale data challenges, examined the emerging role of machine learning, outlined potential applications of the technology, and explored some of the challenges of machine learning. Dr. Yelick used a simple example to explain what machine learning programs do. She stated that a machine learning program can be "fed" ten million images, some of which contain cats and are labelled as containing cats. From those images, the program can "learn" how to identify cats in images and then be used to find images containing cats from massive sets of data. While a trite example, Dr. Yelick stated these kinds of programs have almost unlimited scientific applications and can revolutionize scientific research itself. She stated DoE is

uniquely positioned to promote the development of machine learning for the betterment of the United States.

C. Dr. Matthew Nielsen (Principal Scientist, Industrial Outcomes Optimization, GE Global Research)

Dr. Nielsen began his testimony explaining the role GE plays in the management of energy, stating that GE's software manages over 40 percent of the world's energy supplies. His testimony focused on the industrial applications of machine learning. Dr. Nielsen testified that machine learning programs can continuously update, allowing a near-real-time view of energy supply chains, from extraction machines all the way to final delivery to customers. Moreover, Dr. Nielsen stated that cyber threats are increasingly jeopardizing the United States' critical energy infrastructure. He testified that GE is applying machine learning technologies to develop a "digital immune system" that can detect, analyze, and autonomously respond to cyber intrusions into critical infrastructure. He stated that public-private partnerships can play a vital role in developing these kinds of technically advanced but highly applicable technologies. He concluded his testimony describing the ways in which Congress may support the advancement of machine learning techniques in the United States: continue funding public-private research opportunities, encourage the collaboration between machine learning experts and industry stakeholders, and continue investing in the United States' high-performing computer systems (super computers).

D. Dr. Anthony Rollett (U.S. Steel Professor of Materials Science and Engineering, Carnegie Mellon University)

Dr. Rollet, as a metallurgist, focused his testimony on manufacturing techniques that can be developed by machine learning, particularly 3D printing. He testified that machine learning may be applied to understand the effectiveness and reliability of 3D printing, allowing this new technique of manufacturing to move from the realm of university research labs to high-tech industry roles, such as manufacturing jet engine parts. He stated Congress may continue to invest in machine learning techniques, promote STEM education in the United States, and encourage public-private partnerships in the field to ensure the United States plays a leading role in developing and managing this new technology.

V. Question & Answer:

A. Department of Energy's Role

Chairman Weber asked the panelists which countries most closely compete with the United States when it comes to the national infrastructure developed to research machine learning. **Dr. Kasthuri** stated Germany and China are the United States' closest competitors. **Dr. Yelick** stated that China has an impressive supercomputing manufacturing infrastructure, catalyzing their research in the field.

B. Big Data and Machine Learning Applications

Representative Beyer asked **Dr. Kasthuri** about the risks of developing artificial intelligence with consciousness. **Dr. Kasthuri** stated that most people already have experience dealing with this "problem." He gave the example of dealing with his own children, his own creation that developed consciousness that ended up being smarter than their creator. **Dr. Kasthuri** testified that society has developed ways to manage this development, such as teaching children value systems and, from time to time, taking away the car keys.

Representative Lesko asked the panelists how machine learning is being applied to national security issues. **Dr. Nielsen** stated machine learning may analyze group behavior and facial motions to understand the *intent* of individuals using solely images. This technology would allow national security professionals to target potentially nefarious actors.

Representative Esty asked the panelists how diversity can be included in the development of machine learning algorithms. **Dr. Yelick** stated that machine learning and artificial intelligence algorithms reflect the values and prejudices of the humans that create the programs, making it vital that a diverse group of humans create the computer programs that could affect people's lives.

C. Education Infrastructure

Representative Bonamici asked **Dr. Rollet** how the United Stated can promote intellectual flexibility. **Dr. Rollet** stated that the United States needs to promote a "try this" mentality among its university students when it comes to new technologies. He stated that once students "jump into" new technologies, they often find the applicability of new computing techniques to their own research problems very useful.