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Lamar Smith, Chairman

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Statement by Chairman Lamar Smith (R-Texas)

Big Data Challenges and Advanced Computing Solutions

Chairman Smith: Today we will hear from a panel of experts on a number of big data challenges facing the Department of Energy (DOE), academia, and industry, and the innovative computing approaches used to address them.

Recent advances in our ability to store and process information have led to a growth of large and complex data sets. At the same time, greater computing power and increasingly sophisticated algorithms have allowed for dramatic advances in artificial intelligence and machine learning. These tools have powerful applications for challenges with a large amount of data on which to train computing systems.

Machine learning is a practice in which computers not only analyze data, but then use that analysis and data to refine and enhance future predictions. Essentially, it gives computers the ability to learn directly from data without being explicitly programmed.

This advanced technology is already creating tremendous developments in many fields including medicine, manufacturing and finance.

Whether it's protecting your credit card from fraudulent activity to helping you find the fastest way to work, we all benefit from machine learning every day.

Machine learning is especially valuable when analyzing big data. As the nation's largest federal supporter of basic research in the physical sciences, DOE is well suited to develop and apply machine learning across its research portfolio.

DOE funds robust programs in advanced scientific computing and applied mathematics, and hosts the fastest supercomputers in the world at DOE national labs. The Department also funds research in a wide range of scientific disciplines—from physics and chemistry, to materials science and biology.

DOE has a specific research need to address big data challenges and is uniquely positioned to advance machine learning-based approaches to solving these challenges.

For example, machine learning-based algorithms have the ability to revolutionize material science research. The discovery of new materials has been instrumental to many recent advancements in carbon capture, battery and solar cell technologies. At Lawrence Berkeley National Laboratory and at SLAC National Accelerator Laboratory, researchers are utilizing machine learning-based approaches to shorten the timeline of the materials discovery process.

Machine learning is also particularly useful in the biological and biomedical sciences. In many of these areas, like the study of microbial data, the behavior of proteins, and even patient care, we have the potential to make significant scientific progress by using detailed analysis of large amounts of data.

At Argonne National Laboratory, researchers have a plan to create a 3D map of neurons in the human brain. By utilizing the imaging power of the Advanced Photon Source, and the leadership computing facility at Argonne, researchers can collect and fit together millions of high resolution images of mammal brains to reconstruct their complex structures and characterize their behavior. I look forward to hearing more about this exciting area of research today.

American universities are also taking advantage of machine learning-based approaches to big data challenges. At Carnegie Mellon University's NextManufacturing Center, researchers have focused on how to combine 3D printing and machine learning to monitor the quality of manufactured components in real-time.

These are just a few of the issues already being addressed by machine learning. Continued development will allow us to address more complex challenges and advance scientific discovery.

With new exascale and quantum computing systems, more big data challenges will be within our reach. We must continue to support the research in applied mathematics and computer science that will help develop the next generation of computing tools.

I thank the witnesses for their testimony and look forward to a valuable discussion of this important science today.

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