ask the Fed®

Live from Texas: Basics of Fintech

Artificial Intelligence (AI) and Machine Learning (ML)

November 8, 2019

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Overview

- **What is AI?**
- **Why is there so much interest in AI and ML recently?**
- **How are banks beginning to use AI and ML?**
- **What should I be keeping in mind?**
- **Caution:**
  - These are preliminary views.
  - Regulatory and supervisory expectations regarding AI and ML, as well as the technologies themselves, are still developing.
  - Market developments and potential examinations of Federal Reserve System-supervised banks will inform future versions of this presentation and may alter its conclusions.

What are AI and ML?

- **Financial Stability Board: “[ML is a] method of designing a sequence of actions to solve a problem that optimizes automatically through experience and with limited or no human intervention.”**
- **How do you learn without being explicitly programmed?**
- **Imagine that we are trying to build a computer program that recognizes images of cats.**
- **Before ML, we used the “expert systems approach.”**
- **With ML, you work “backwards” from the data.**

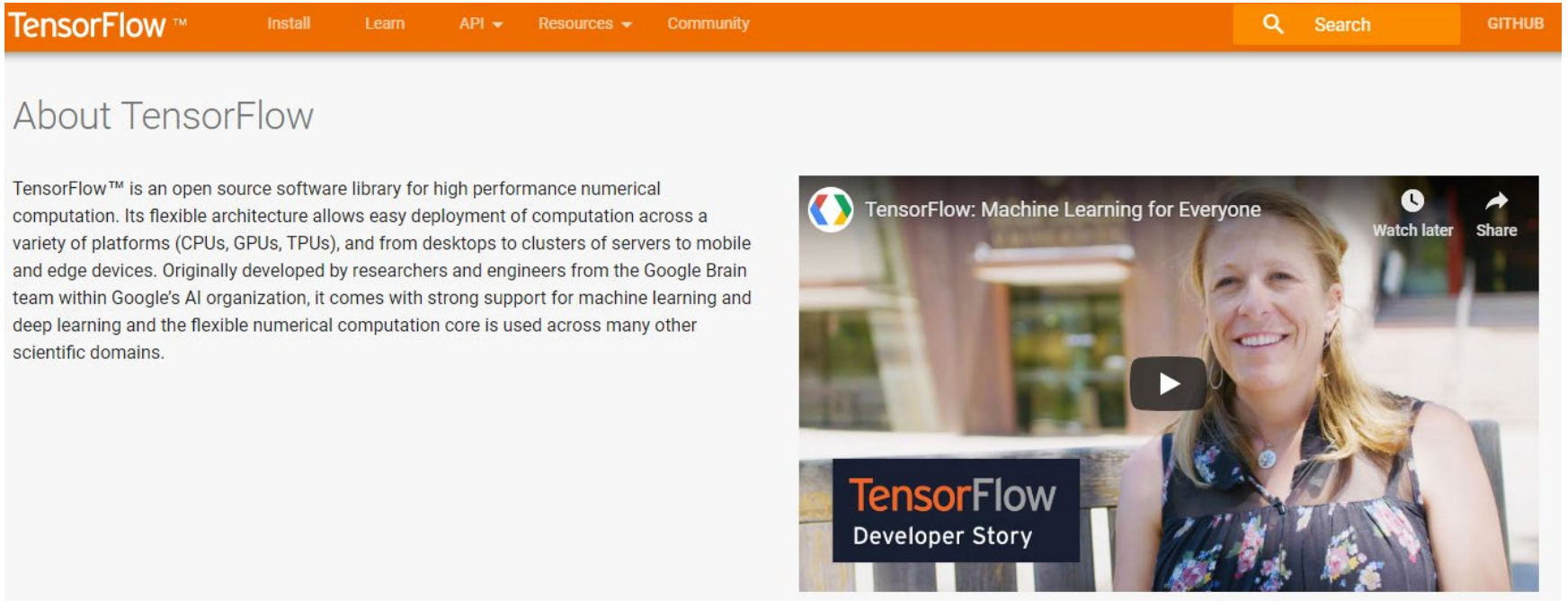
Image Recognition Challenges: The Muffin or Chihuahua Test

Why is there so much interest in AI and ML recently?

- **The three primary ingredients for ML are now widely available.**
  - Algorithms
  - Data
  - Computing power

Why is there so much interest in AI and ML recently? (continued)

- **Ingredient #1: Algorithms**
  - ML algorithms are generally open-source and, therefore, available for free to anyone in the world.



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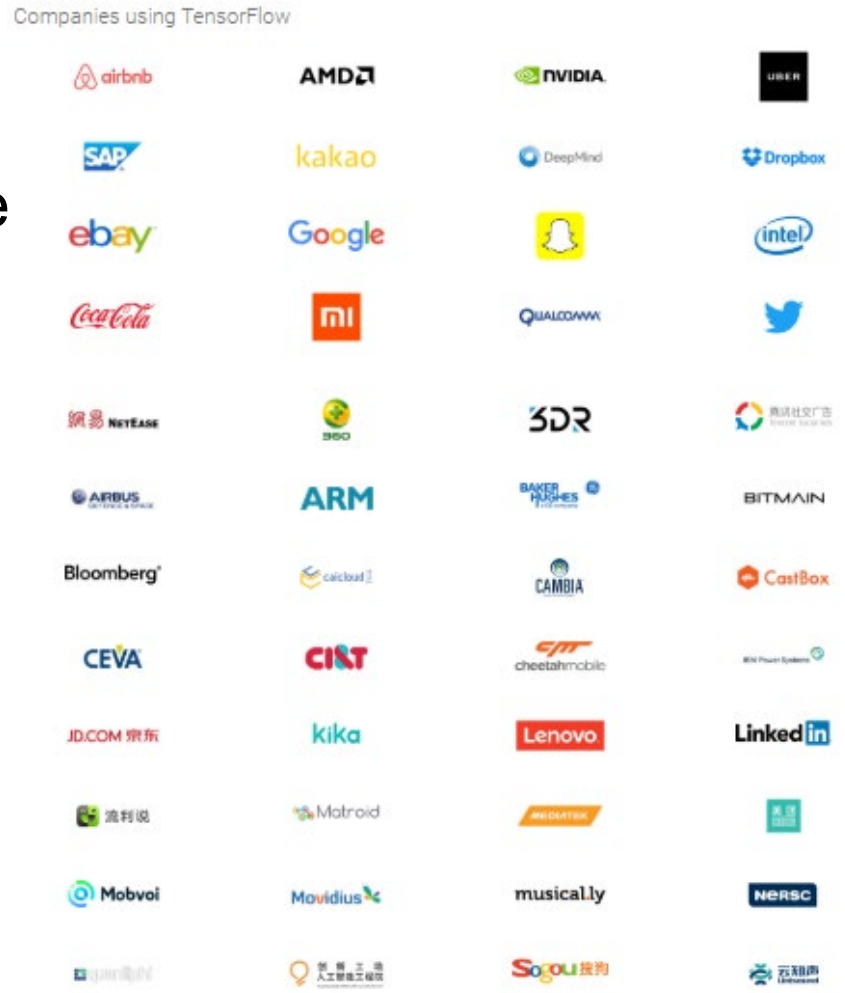
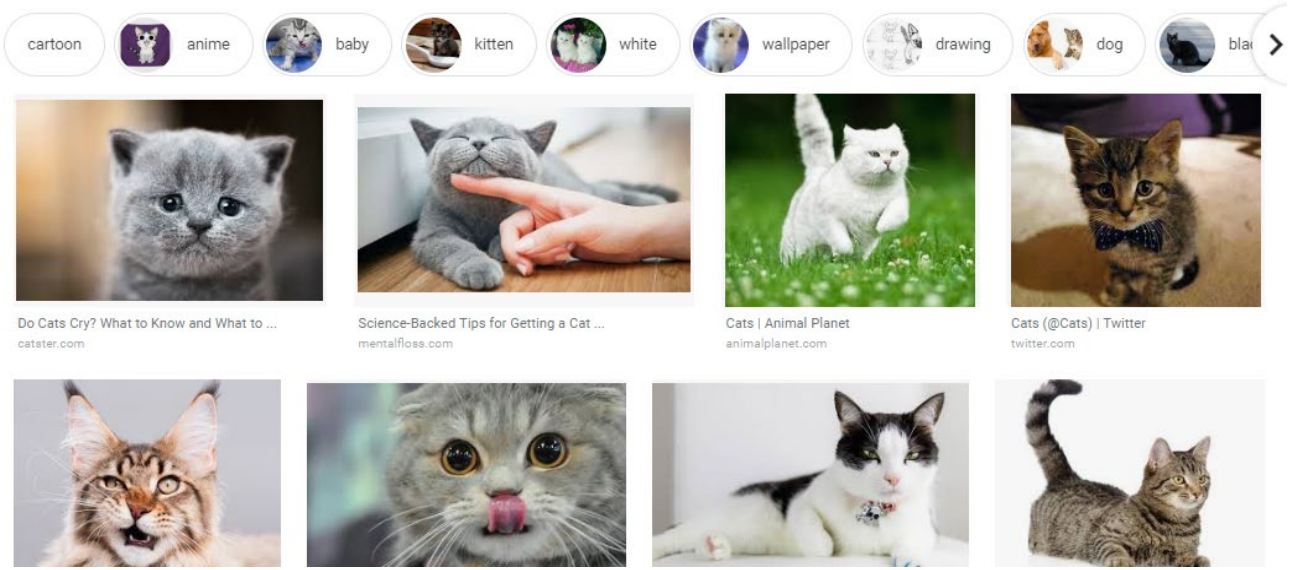


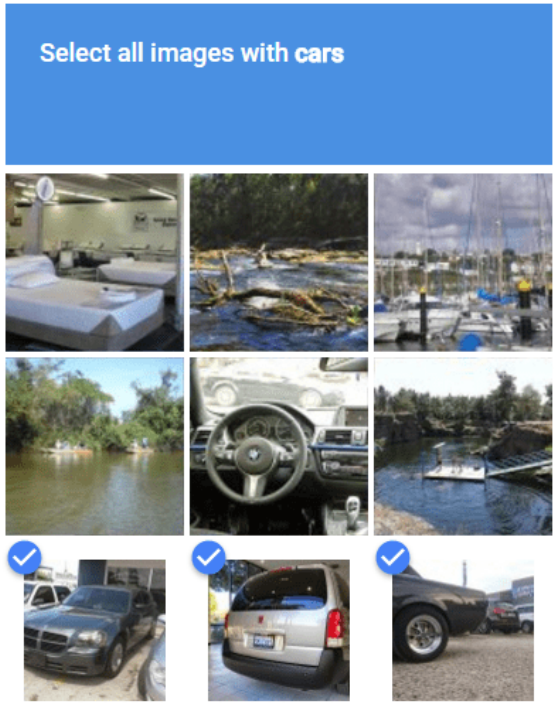
Why is there so much interest in AI and ML recently? (continued)

- **Ingredient #2: Data**
  - Some search engine providers have a head start on the market for ML work, due to their index of millions of pre-classified images.



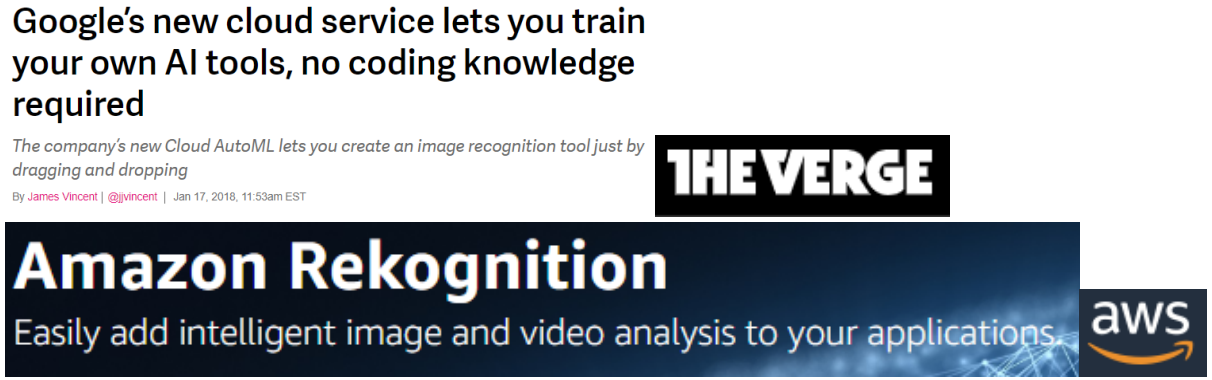
Why is there so much interest in AI and ML recently? (continued)

- **Ingredient #2: Data**
  - You have been helping Google label images for their ML libraries, even though you may not have been aware of it.



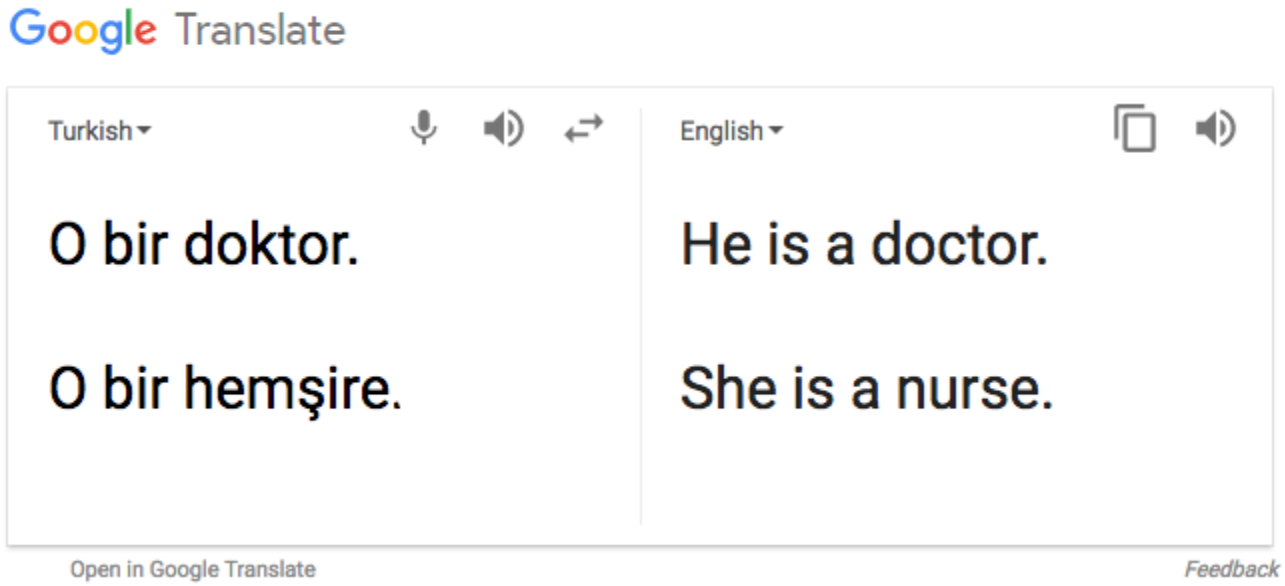
Why is there so much interest in AI and ML recently? (continued)

- **Ingredient #3: Computing power**
  - In 2012, Google used approximately 1,000 computers for three straight days to train its model.
  - Cloud computing offers huge-scale processing power at flexible prices to a wide range of customers, including individuals.
  - OpenAIFive trained for an equivalent of 45,000 years and beat a professional e-sports team in the video game Dota 2.
  - Further, cloud computing providers are increasingly offering pre-packaged ML tools to make it even easier.
  - The Pluribus multiplayer no limit Texas Hold'em poker AI was trained on less than $150 worth of cloud computing resources.



Concerns Raised Outside of Banking

Concerns about bias:



Concerns Raised Outside of Banking (continued)

- **Concerns about transparency and explainability:**
  - In the 1990's, researchers at the University of Pittsburgh created an ML algorithm to predict whether serious complications would develop in patients presenting symptoms of pneumonia.
  - The program determined that having asthma, combined with pneumonia, led to better outcomes than patients that did not have asthma.
  - Accordingly, if you only had pneumonia, the algorithm would often recommend that you be admitted, but if the same person had pneumonia and a history of asthma, it would recommend that the patient be sent home.
  - The algorithm (and its users) didn't account for an important correlation. Patients with pneumonia and asthma had better outcomes, because they were often automatically admitted to intensive care.

How are banks beginning to use AI and ML?

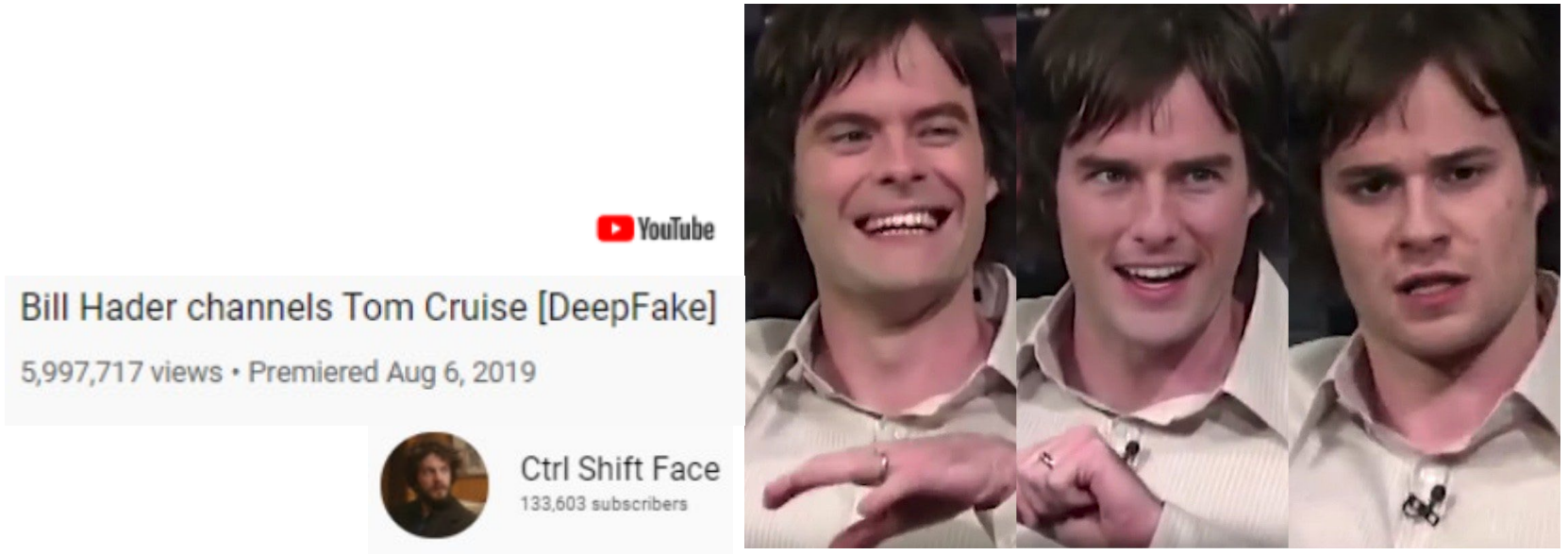
- **Fraud detection and prevention:**
  - Employee management
  - Cybersecurity breach notification
  - Fraudulent transaction identification
  - Login/call center fraud
- **Bank Secrecy Act (BSA)/ Anti-Money Laundering (AML):**
  - Flagging suspicious activities
- **Consumer credit scoring**
- **Text ingestion:**
  - Company statements
  - Checks
  - Financial crime documentation
- **Retail customer engagement:**
  - Chatbots
  - Customer segmentation
  - Customer relationship management (cross-marketing)
- **Risk controls:**
  - Stress testing
  - Liquidity risk management
  - Derivatives hedging

What should I be keeping in mind?

- As we apply the AI/ML model to parts of our banking processes, what questions will we face from customers, employees, shareholders, and other parties, regarding transparency and explainability?
- How do we develop an appropriate control infrastructure that accounts for these questions, concerns, and risks?
- What do we need to be asking, before we use AI tools, about potential bias reflected in the data used to train the model?
- As AI models are implemented in credit, marketing, and other decision making, how do we identify and address concerns about potential fairness issues?

Factors to Consider

- **Why don’t we just require that all algorithms be transparent, explainable, and fair?**
  - **The wide availability of AI’s building blocks (i.e., algorithms, data, and computing power) means that bad actors have access to best-in-class technologies to build AI tools that are powerful and adaptable.**
  - **Deepfake videos can be easily created by laymen using open-source tools, the widespread availability of training data (e.g., photos and videos), and cloud computing processing power.**



Factors to Consider (continued)

- **The U.S. Department of Defense funded a contest to develop tools that can digitally detect deepfake videos.**
- **By accessing data sets with consumers' personally identifiable information and applying open-source AI tools, a phisher may be able to churn out highly targeted emails to millions of consumers at relatively low cost, containing personalized information such as their bank account number and logo, along with past transactions.**
- **"In cases such as this, where large data sets and AI tools may be used for malevolent purposes, it may be that AI is the best tool to fight AI." – Federal Reserve Governor Lael Brainard, November 2018**

Available Guidance

- **SR Letter 11-7, “Guidance on Model Risk Management”:**
  - Supervisors expect appropriate controls over firms’ applications and technologies and how they are used.
  - This is especially true for any applications/technologies that are new and not fully tested in a variety of conditions.
  - Banks should consider the appropriateness of each individual use
  - Importantly, the guidance recognizes that not all aspects of a model may be fully transparent, as with proprietary vendor models, for instance.
  - Banks can use such models, but the guidance highlights the importance of using other tools (like “circuit breakers”) to cabin or otherwise mitigate the risk of an unexplained or opaque model.

Available Guidance (continued)

- **SR Letter 13-19/CA Letter 13-21, "Guidance on Managing Outsourcing Risk":**
  - The guidance discusses best practices for supervised firms regarding due diligence, selection, and contracting processes in selecting an outside vendor.
  - It also describes ways that firms can provide oversight and monitoring throughout the relationship with the vendor, and considerations about business continuity and contingencies for a firm to consider before the termination of any such relationship.

Available Guidance (continued)

- **SR Letter 18-10, "Joint Statement on Innovative Efforts to Combat Money Laundering and Terrorist Financing":**
  - Issued by: FRB, FDIC, FinCEN, NCUA, OCC
  - To "encourage banks to consider, evaluate, and, where appropriate, responsibly implement innovative approaches to meet their [BSA/AML] compliance obligations. . ."
  - "While the Agencies may provide feedback, pilot programs in and of themselves should not subject banks to supervisory criticism even if the pilot programs ultimately prove unsuccessful."
  - "[P]ilot programs that expose gaps in a BSA/AML compliance program will not necessarily result in supervisory action with respect to that program. . . In these instances, the Agencies will assess the adequacy of banks' existing suspicious activity monitoring processes independent of the results of the pilot program."
  - "Further, the implementation of innovative approaches in banks' BSA/AML compliance programs will not result in additional regulatory expectations."
  - "The Agencies will not penalize or criticize banks that maintain effective BSA/AML compliance programs commensurate with their risk profiles but choose not to pursue innovative approaches."

FRB – Federal Reserve Bank; FDIC – Federal Deposit Insurance Corporation; FinCEN – Financial Crimes Enforcement Network; NCUA – National Credit Union Administration; OCC – Office of the Comptroller of the Currency

Available Guidance (continued)

- **Guidance has to be read in the context of the relative risk and importance of the specific use case in question.**
  - We have long taken a risk-focused supervisory approach.
  - The level of scrutiny should be commensurate with the potential risk posed by the approach, tool, model, or process used.
- **In some cases, statutes and regulations make that risk weighting explicit—consumer, in particular.**
  - The Equal Credit Opportunity Act (ECOA) and the Fair Credit Reporting Act include requirements for creditors to provide notice of the factors involved in taking actions that are adverse or unfavorable for the consumer.
  - ECOA also prohibits lenders from considering certain protected characteristics, such as race and national origin, when making lending decisions.
  - These requirements apply to all transactions large or small.

Concluding Thoughts Regarding ML

- **Our opening assumption is that these types of technologies can be brought under firms' existing control infrastructures, looking to currently available guidance.**
- **The technical, regulatory, and supervisory issues are still evolving, however.**
- **Accordingly, we encourage a good dialogue with the industry, particularly about whether current requirements and expectations are appropriately suited for ML.**

To Learn More

- "Where Do Consumers Fit in the Fintech Stack?"
  – Lael Brainard (November 2017)
- "What Are We Learning about Artificial Intelligence in Financial Services?"
  – Lael Brainard (November 2018)
- "Keynote: A Conversation on Machine Learning in Financial Regulation"
  – Randall Quarles (May 2018)
- "Keeping Fintech Fair: Thinking About Fair Lending and UDAP Risks"
  – Carol Evans (2017)

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