Data Science: What It Is and How It Can Help Your Company

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Which of the below is closest to your job title?

- ❑ Engineer, Architect, Analyst
- ❑ Manager, Director, VP
- ❑ CEO, COO, CTO
- ❑ Project Manager
- ❑ Consultant
- ❑ Student
- ❑ Other

What industry do you work in?

- ❑ Aerospace
- ❑ Academia
- ❑ Banking
- ❑ Computer Security
- ❑ Consulting
- ❑ Insurance
- ❑ Retail
- ❑ Software Engineering
- ❑ Other *(please specify in comments)*

Eliezer Kanal

- PhD in biomedical engineering from University of Pittsburgh
- Technical Manager at CERT (Software Engineering Institute, CMU)
- Previous experience:
  - Quantitative analyst at PNC Bank
  - Manager of Metrics and Analytics at Highmark, Inc.
- Expertise in signal processing, operations research, machine learning

Brian Lindauer

- Graduate certificate in Mining Massive Data Sets from Stanford University, B.S. in Computer Science from Columbia University
- Research Scientist in CERT (Software Engineering Institute, CMU)
- Previous experience:
  - Principal Software Engineer at Raytheon
  - Software Engineer at CounterStorm, built network anomaly detection systems
- Expertise in machine learning, software engineering, and cybersecurity

“Data Science” – note differences!

Eliezer

- Biomedical Engineering
- Predicting when businesses default on loans
- Optimizing call center staffing

Brian

- Computer Science
- Network security defense
- Predicting cybersecurity attacks

Similarities:

- Shared skill set
- Similar tools
- (Somewhat) similar training
- *Problem solving!*

Data Science skills

- **Statistical/Machine Learning techniques**
- **Data manipulation**
- **Information visualization**
- **Intermediate programming**
- **Quick learners**
- **Able to think of** <adjective> **questions**
  - …answerable...
  - ...intelligent...
  - ...relevant...
  - ...value-added...

Any particular topic you want to hear about?

- ❑ Insurance Operations Optimization
- ❑ Retail Traffic Maximization
- ❑ Credit Card Fraud
- ❑ Call Center Management
- ❑ Insider Threat Management
- ❑ Network Security
- ❑ Airline Safety

Case Study: Call Center Optimization

Project goal:

Determine optimal staffing pattern so as to meet a variety of contractual performance guarantees while minimizing staffing costs.

Data Science approach:

Identify historical call time distributions, create software to automatically recommend staffing needed to meet guarantees.

Skills used:

Quick learning, distribution fitting, algorithm development, data manipulation, programming

Case Study: Network Anomaly Detection

Project goal:

Detect abnormal, possibly malicious activity on a computer network and provide information for an analyst to determine a proper course of action.

Data Science approach:

Model normal network traffic and alert on unusual behavior matching known malicious patterns

Skills used:

Machine learning, systems programming, data manipulation and analysis, high-speed data processing, cybersecurity domain knowledge

What's in a name?

Business Analyst

Decision Support Analyst

Technical Analyst

Business value:

- Gather, condense, and present information
- Minimal-to-moderate technical expertise

Data Scientist

Business value:

- Extract actionable insights from existing data
- Think of as-of-yet unasked questions and answer them
- Machine learning and statistical expertise
- Assist with solution implementation

Questions on what Data Science means?

Questions on distinctions between Data Scientists and other positions?

Case Study: Insurance Claims Optimization

Project goal:

Determine trends in failure for claims to auto-adjudicate, identify actionable fixes

Data Science approach:

Use big data tools capable of handling >1B claims. Cluster similar claims to identify common attributes.

Skills used:

Big data retrieval and manipulation, clustering, data visualization

Case Study: CMU/Boeing Partnership

Project goal:

Determine improvements to be made to aircraft maintenance and safety through automated techniques.

Data Science approach:

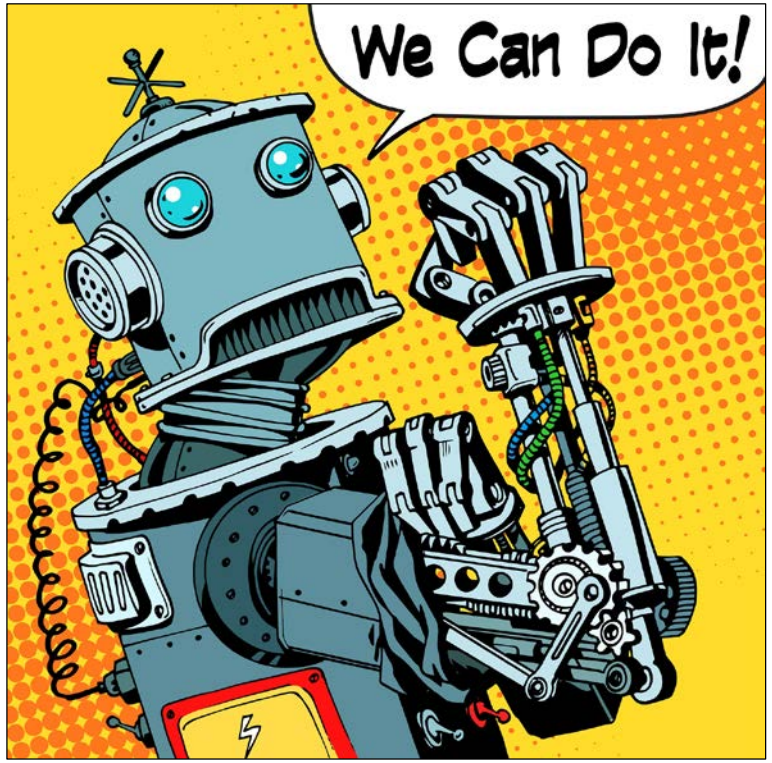
Collect and study data from countless sensors deployed throughout the aircraft to determine numerous aspects related to safety.

Skills used:

Big data collection & manipulation, quick learning, asking new questions

https://www.cs.cmu.edu/news/boeing-establishes-analytics-lab-aerospace-data-carnegie-mellon

What is Machine Learning?



Tom Mitchell, former CMU Machine Learning department chair:

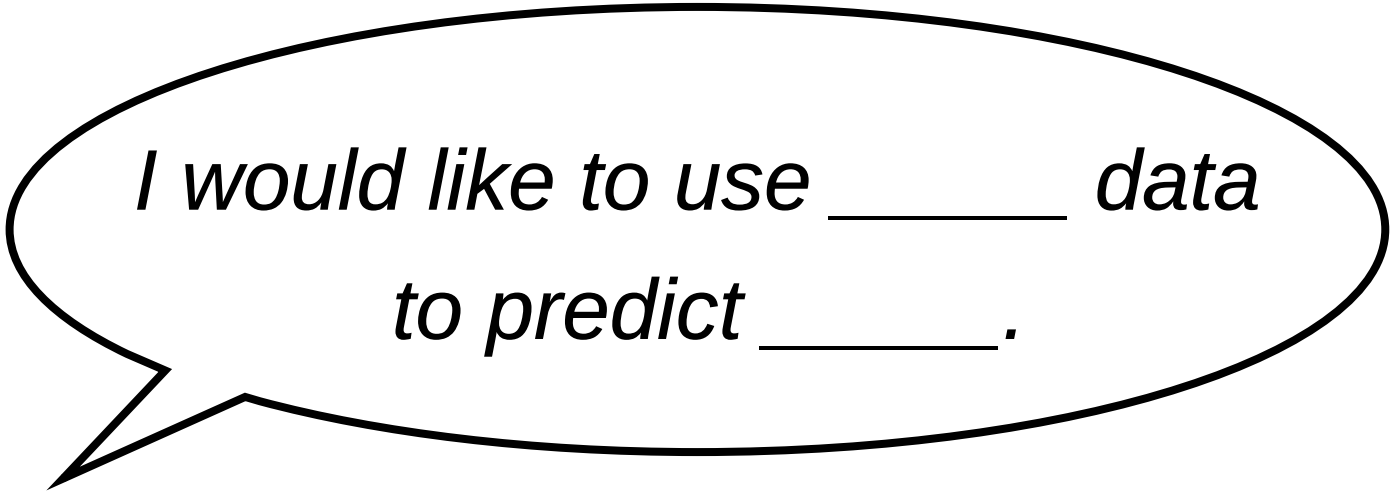
> *The field of Machine Learning asks the question, "How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?"*

Machine Learning seeks to automate data analysis and inference.

What is Machine Learning?

Picture (optional)

If your problem can be stated as:



…you would likely benefit from machine learning.

Case Study – Credit Card Fraud

Project goal:

Automatically detect fraudulent credit card transactions as they occur.

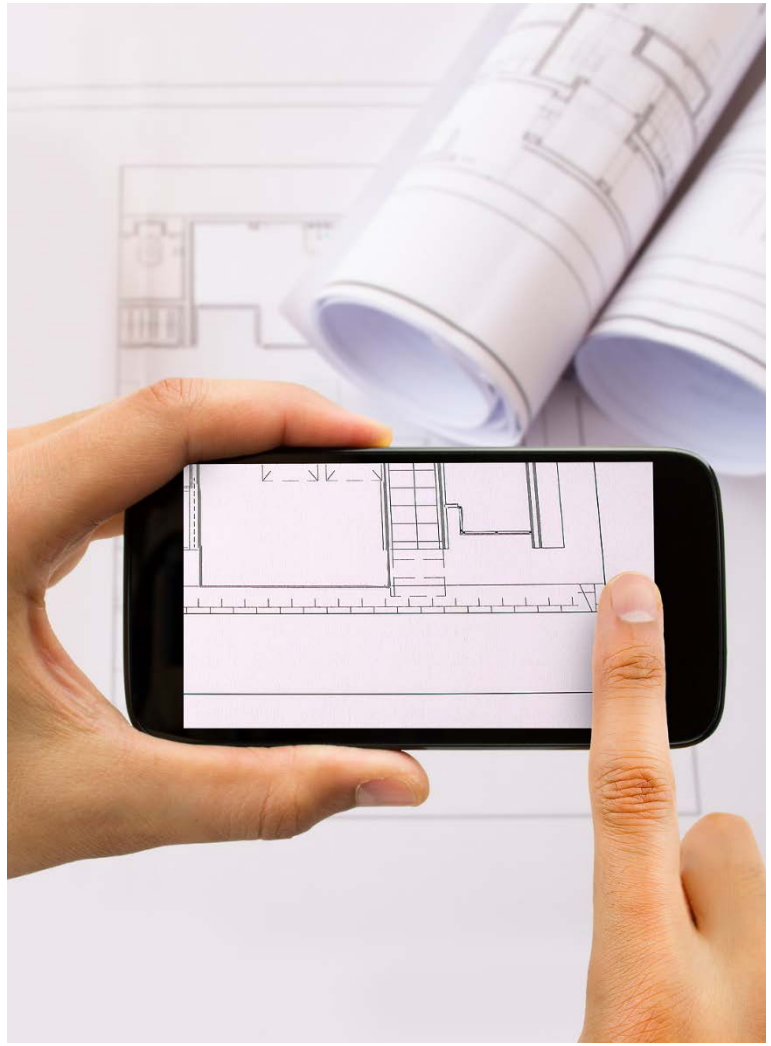
Data Science approach:

Create machine learning model based on historical transaction data to determine what combinations of attributes signify a fraudulent transaction.

Skills used:

Big data manipulation, machine learning and statistical techniques, value-added questions

Case Study – Insider Threat Detection



Project goal:

Identify employees either acting maliciously or at risk of becoming malicious actors.

Data Science approach:

Automatically mine email, workstation activity, badging records, etc. for unusual activity matching patterns of suspicious behavior, indicate where intervention is required.

Skills used:

Big data, natural language processing, machine learning/statistics, domain expertise

Case Study – Retail

Project goal:

Increase store activity by providing customers with coupons they are most likely to find useful

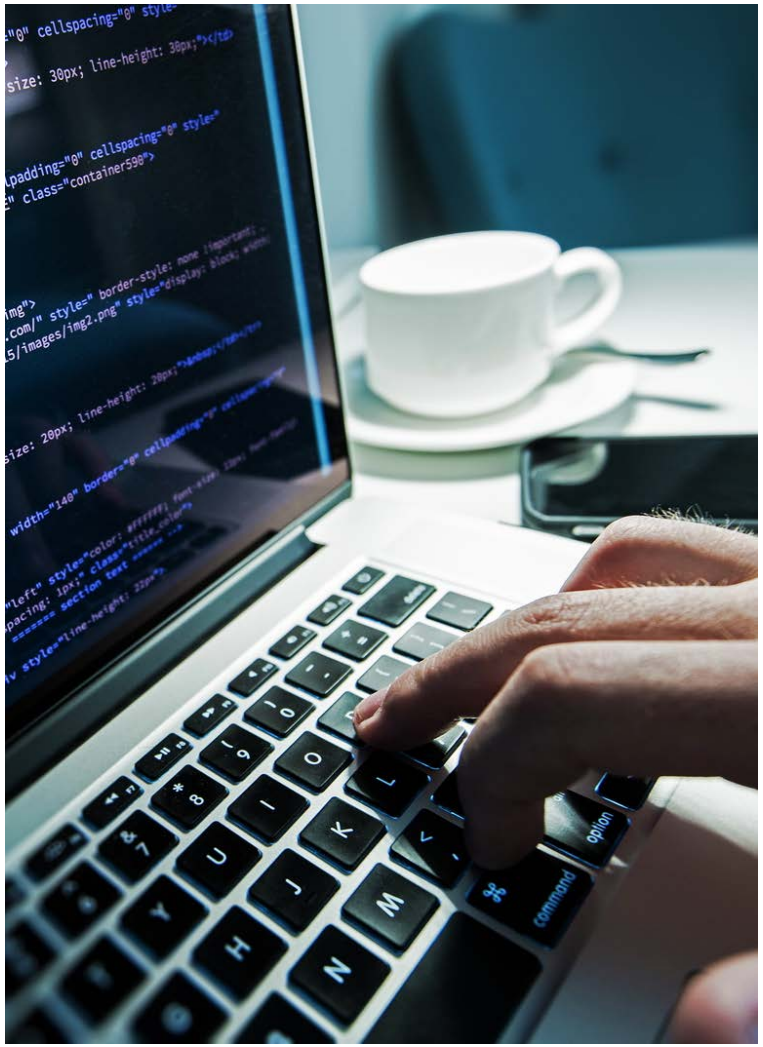
Data Science approach:

Build a recommender system using historical data, recommend future purchases. Identify which products are likely to be bought together and provide coupons for groups of products.

Skills used:

Big data manipulation, machine learning and statistical techniques

Case Study – Software Development



Project goal:

Decrease the number of bugs in released software.

Data Science approach:

1) Create a deep learning model to detect bugs
2) Build a grammar model and examine for irregular usage or known bad practices

Skills used:

Natural language processing, data extraction and manipulation, statistics and machine learning

Takeaway Points

- Data Scientists have very diverse backgrounds
- Critical Data Scientist skills:
  - Statistics and Machine Learning skills
  - Data manipulation
  - Knows how to add value to your organization
  - Quick learner
- Machine Learning: "*I want to use* _____ *data to predict* _____*.*"
- Data Science can add value to your organization

Contact Us

SEI can assist you with your data and analytics needs… reach out to us!

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