tescometering.com

Predictive Maintenance and AI

An Introduction

TESCO's Meter School

TESCOOL

July 12, 2023

9(:00 AM – 10:00 AM

James Tramel

AGENDA

- Introduction
- History and Statistics
  - High level – what matters and why
- Analytics
  - Rationalizing and Presenting data
  - Understanding vs Testing
- Machine Learning
  - Cloud and compute
  - Data engineering and Data science
- Predictions and Decisions
  - Injecting change
  - Assumptions and forecasting
- AI
  - Automation
  - Generative
- Predicative Maintenance
  - Fault tolerance
- What's next

James Tramel

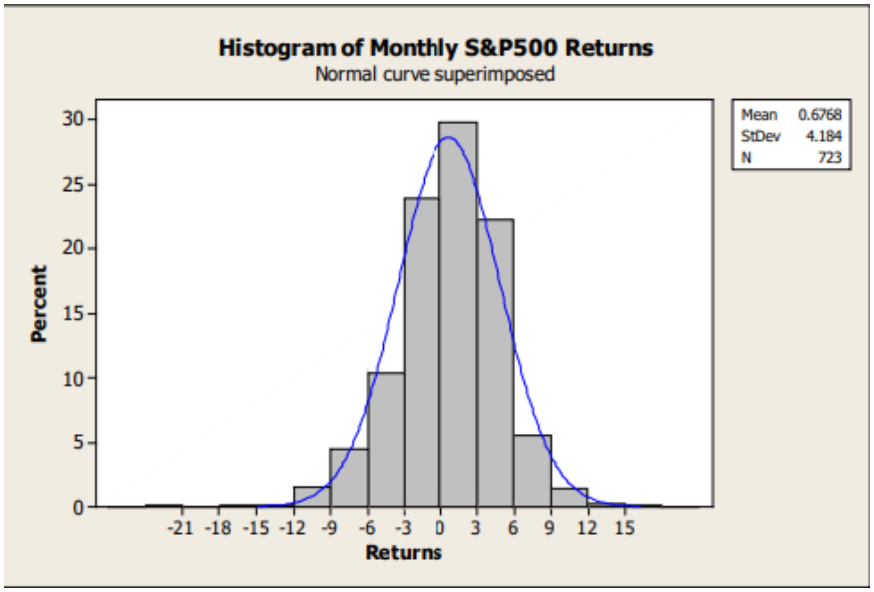
- NYU Stern – Master's in Risk Management
- Microsoft – 8 years – Developer Division
  - Visual Studio / VS code / .NET / Js / Python / Java / GitHub / Azure DevOps / Azure App Services
  - GitHub Code spaces / Playwright / Azure Load Testing
  - Intellicode / Co-Pilot / Developer AI
- Campbell's Soup
- Consulting
  - Web, CRM, ERP, WCM, NextGen, Cloud, Apps, Mobile
- Philosophy / Psychology - Bachelors
- Neuroscience PhD dropout

History and Statistics

1. Average, mean, mode, median
2. Do this a lot = long run frequency

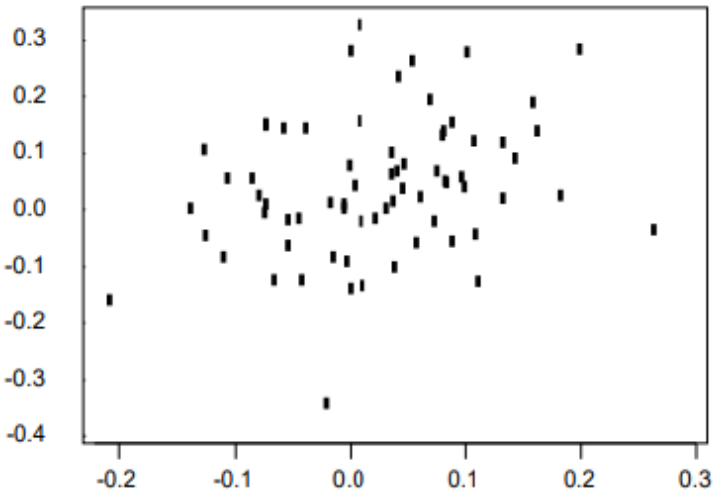
$$P(A) = \frac{\#\ \text{outcomes in event A}}{\text{total \#\ of outcomes}}$$

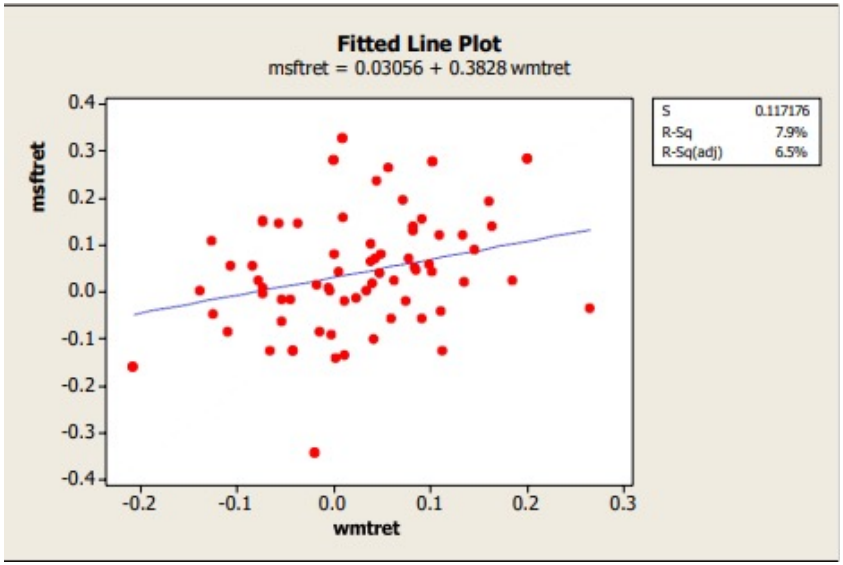
1. Normal distribution
2. Kurtosis



STATITICS

1. Regression / Best fit / Copulas
2. ANOVA
3. MANOVA





ANALYTICS

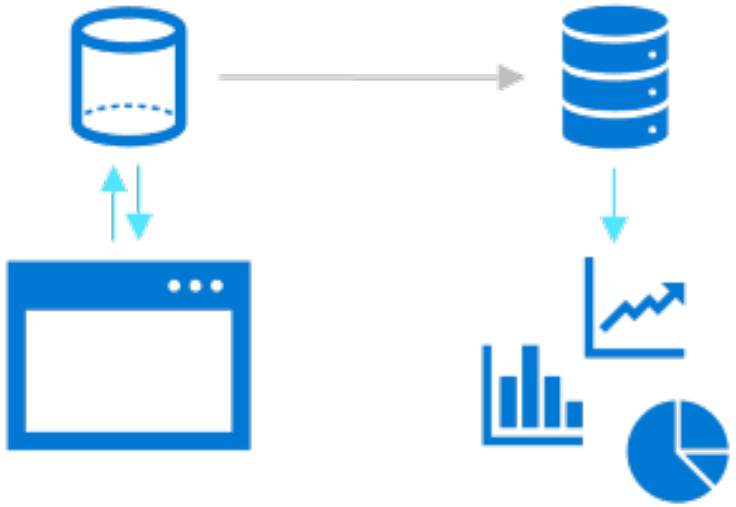
- Discovery, interpretation, and communication of meaningful patterns in data
- Hypothesis testing, null hypotheses
- Excel, PowerBI - demo

Machine Learning

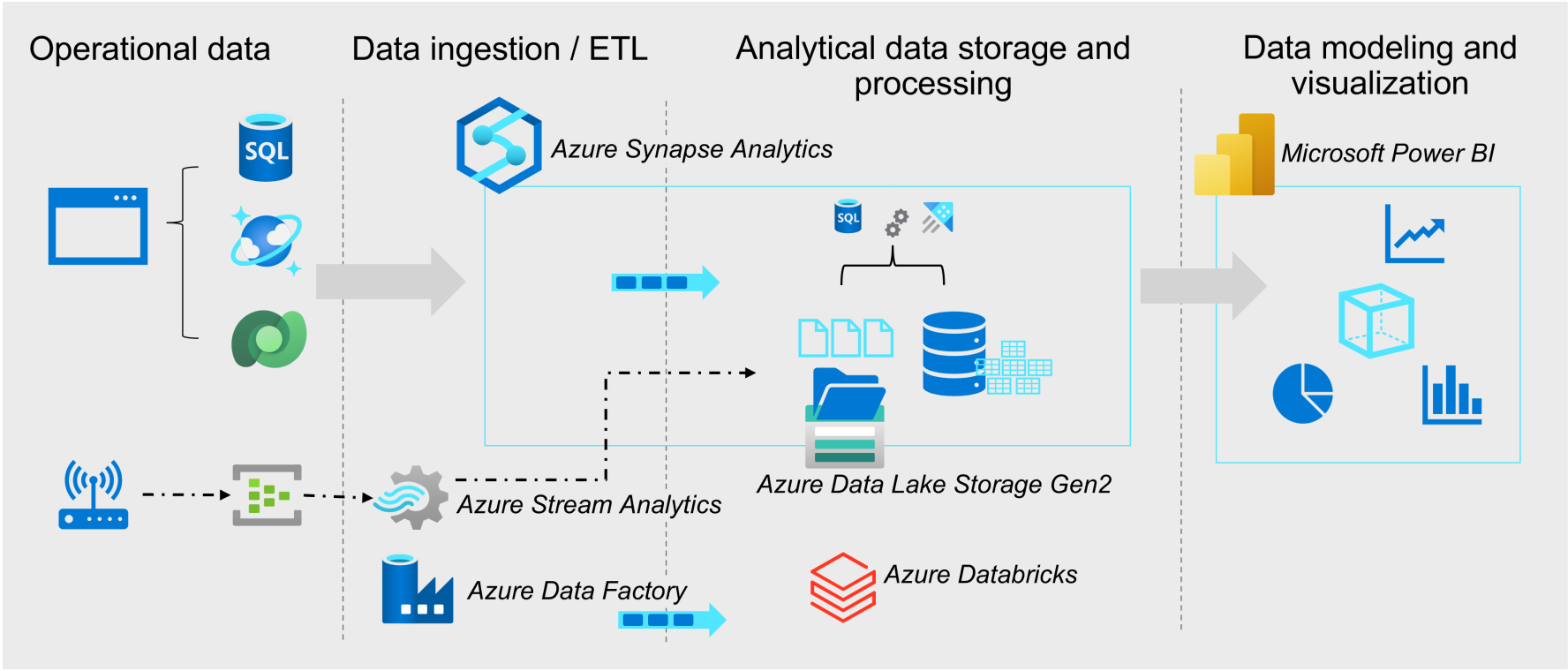
- Cloud and Compute
  - CPU, GPU, Quantum

Data Engineering and Data Science

- Data Engineering
  - Structure, semi-structure, unstructured data
  - Integration, consolidation,cleansing transformation
  - Operational and analytical data, streaming data, live data
  - Data pipelines, data lakes, data warehouses



DATA ENGINEERING

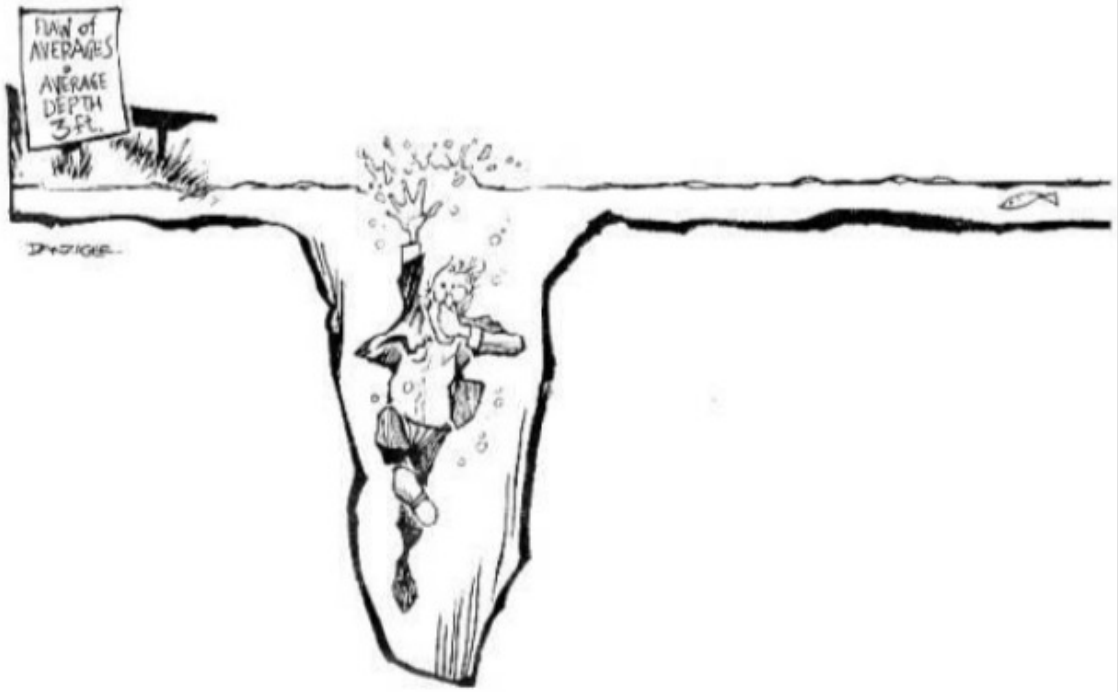


DATA SCIENCE

PREDICTIONS AND DECISONS

Flaw of Averages

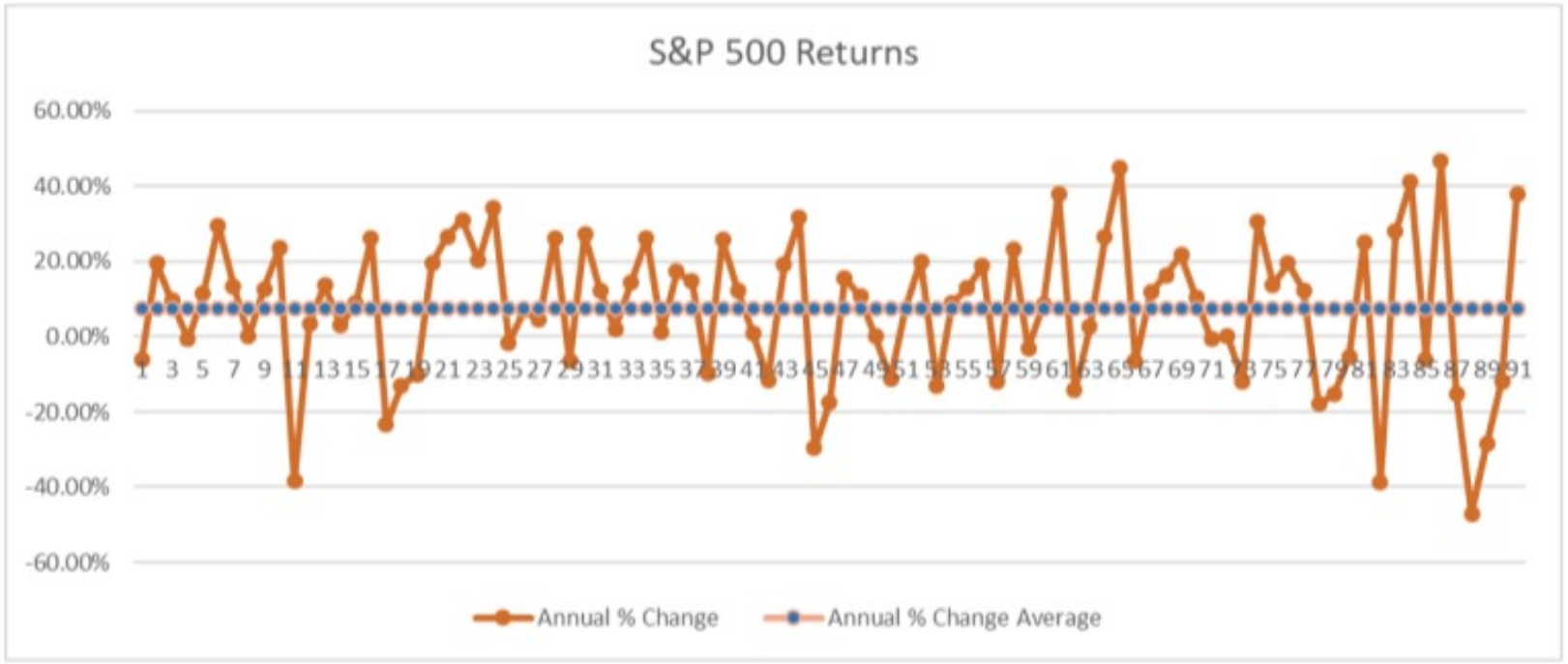
"Never try to walk across a river just because it has an average depth of four feet." —Milton Friedman



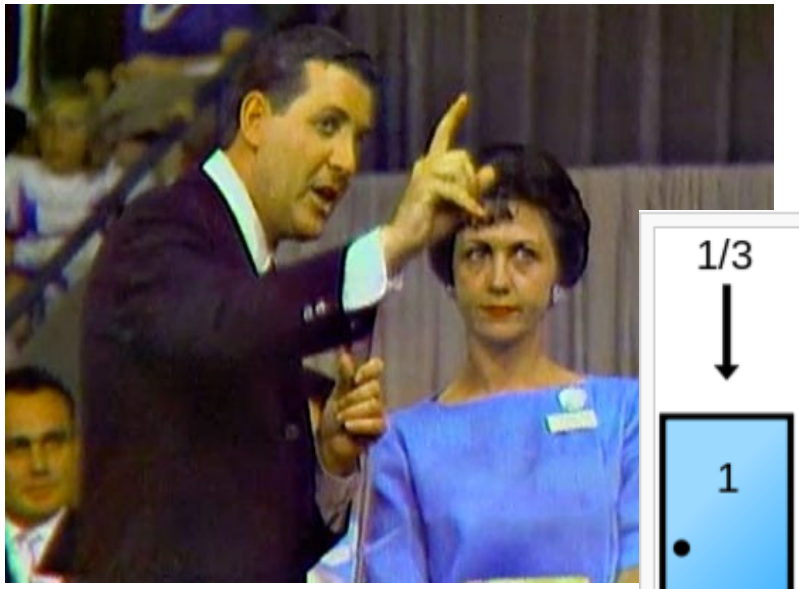
https://web.stanford.edu/~savage/faculty/savage/FOA%20Index.htm

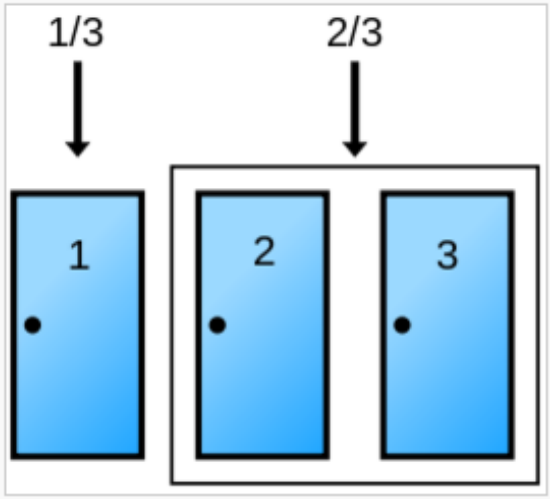
tescometering.com

RANDOMNESS AND CHANCE

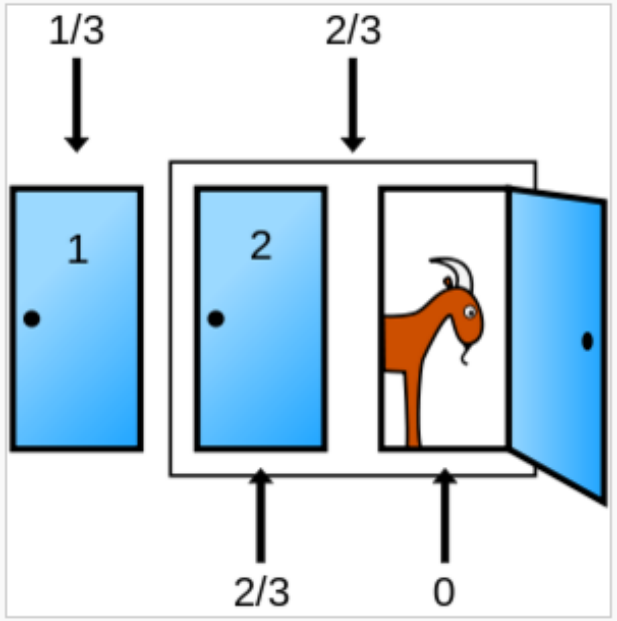


MONTY HALL





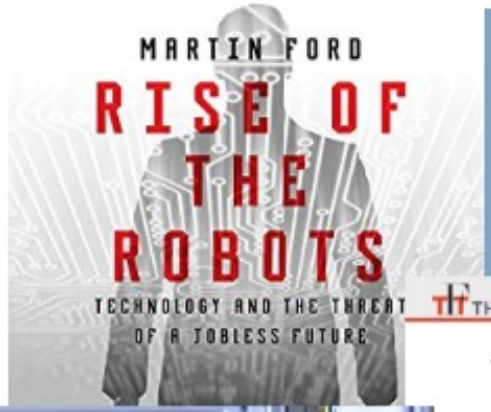
Car has a 1/3 chance of being behind the player's pick and a 2/3 chance of being behind one of the other two doors.

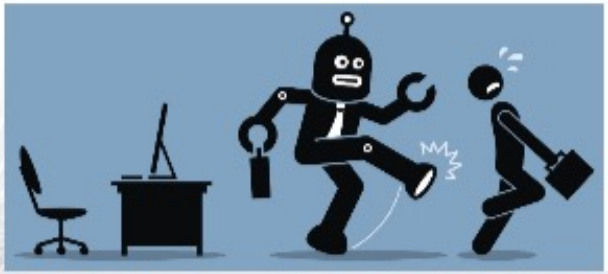


The host opens a door, the odds for the two sets don't change but the odds move to 0 for the open door and 2/3 closed door.

ARTIFICIAL INTELLIGENCE

AI and Robots Will Take All Our Jobs!





THE Fiscal TIMES

POLICY + POLITICS

Millennials vs. Robots—Who Will Win the Jobs?

1980…

A Robot Is After Your Job

By Harley Shaiken

DETROIT — Technological innovation is widely billed as a miracle cure for the United States' economic doldrums. Its aftereffects, however, may be far from benign. The introduction of revolutionary new technologies such as robots — versatile computer-controlled mechanical arms — raise two painful possibilities: sizeable losses of jobs and a deteriorated quality of working life.

The threat of lost jobs, although also dependent on social and economic factors, is especially critical. Auto makers are already buying robots in record numbers, despite a downturn that has resulted in 250,000 indefinite layoffs. Even the faltering Chrysler Corporation has added 120 of these

proportionate impact on a few key industries. Robots that begin work tomorrow will still be on the job in 1980, giving us a robot population of

vasive to assume that enough jobs will automatically be created for the number of people displaced. Economic revitalization no longer means re-employment. And the devastating social cost of unemployment is not reckoned in the savings that technology promises.

Such a socially destructive use of technology need not be inevitable. Jobs for workers displaced and improved working conditions for those who remain ought to be a condition for the introduction of robots. Productivity gains, for example, could translate into a shorter work week at the same pay rather than into fewer jobs. Technology could be designed to enhance human skill and experience

1960…

Robots' Rise

They Bid for Big Jobs
Both in Outer Space
And in U.S. Factories

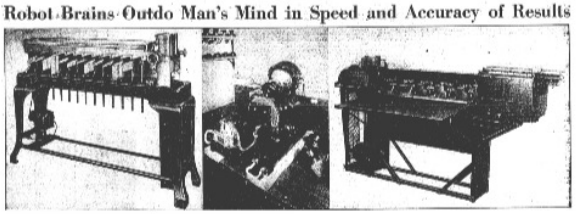
A.M.F. Designs Robot to Send To Moon; G.E. Works on One to Paint New Autos

"But these machines, nevertheless, are true robots—automatic devices that perform human functions or operate with seemingly human intelligence."

Wall Street Journal, July 1960

1935…

Robot Brains Outdo Man's Mind in Speed and Accuracy of Results



'Thinking Machines' Replace the Thinker

They Predict Tides, Pick Criminals' Fingerprints, Calculate Mathematical Problems, and Perform Amazing Tasks.

Washington Post, January 1935

…1812…

One Thousand
POUNDS
REWARD.

WHEREAS on the Night of Sunday the 19th of January, 1812, the Mill belonging to

Messrs. Oates, Wood and Smithson,

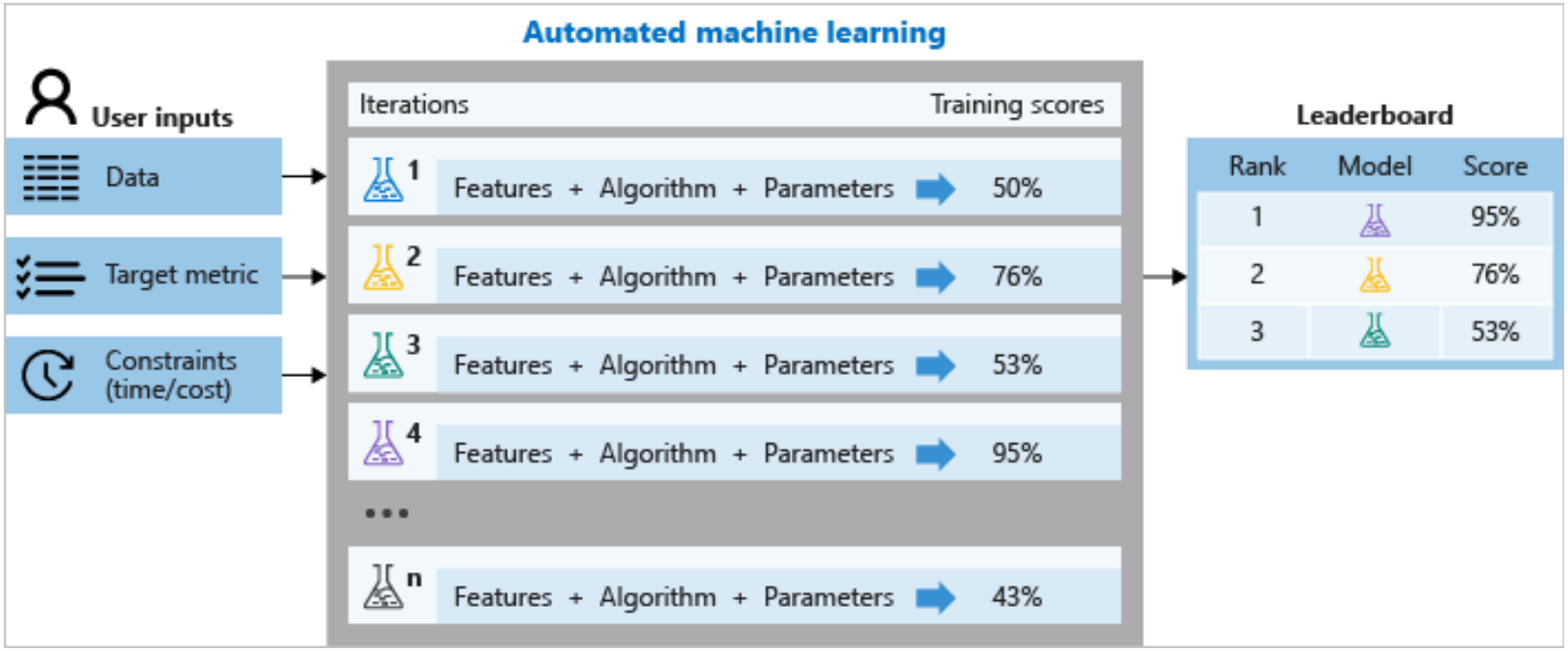
Messrs. Dickinson, Carr and Co.

Wantonly destroyed Cloth,
TO A CONSIDERABLE AMOUNT.

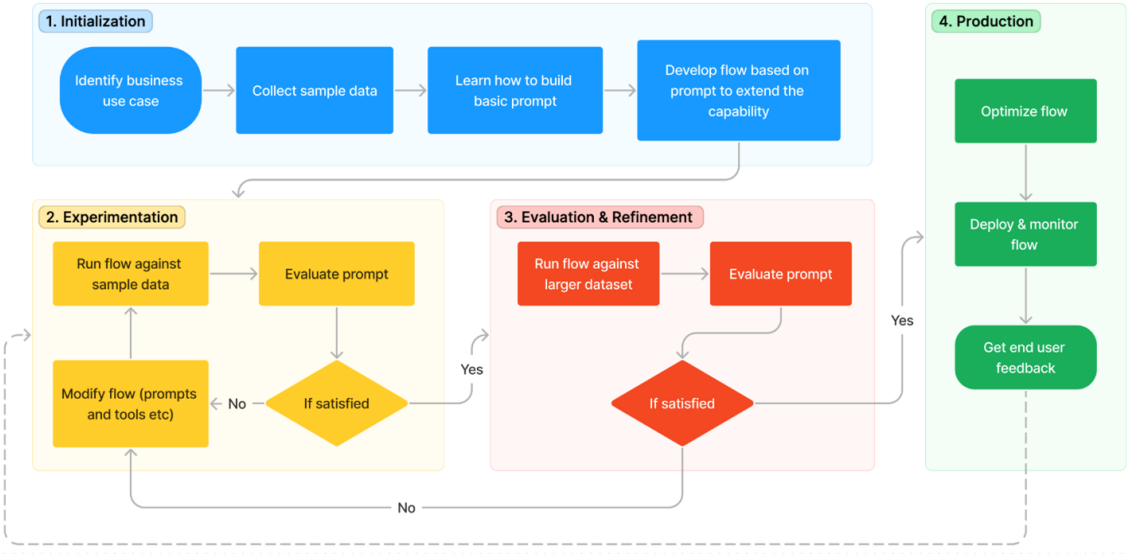
1000 POUNDS
REWARD

Reward Poster for Luddite Attacks Near Leeds, March 1812

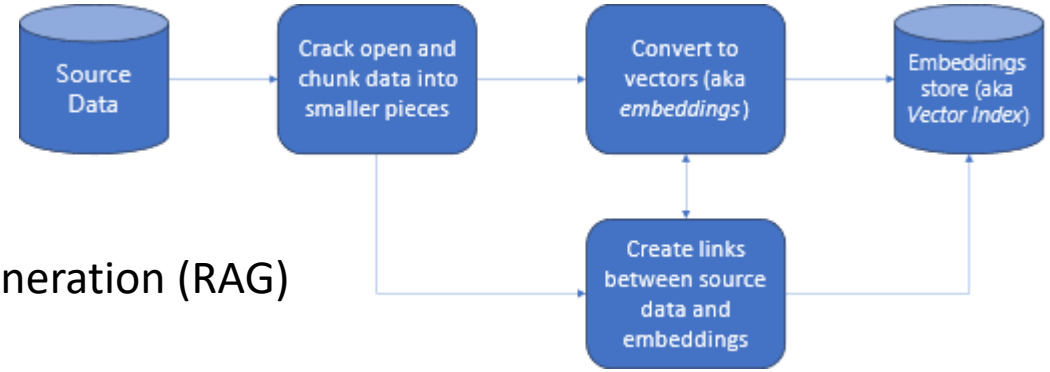
AUTOMATED


Automated machine learning
User inputs
Data
Target metric
Constraints (time/cost)
Iterations
Training scores
1 Features + Algorithm + Parameters 50%
2 Features + Algorithm + Parameters 76%
3 Features + Algorithm + Parameters 53%
4 Features + Algorithm + Parameters 95%
n Features + Algorithm + Parameters 43%
Leaderboard
Rank Model Score
1 95%
2 76%
3 53%

GENERATED

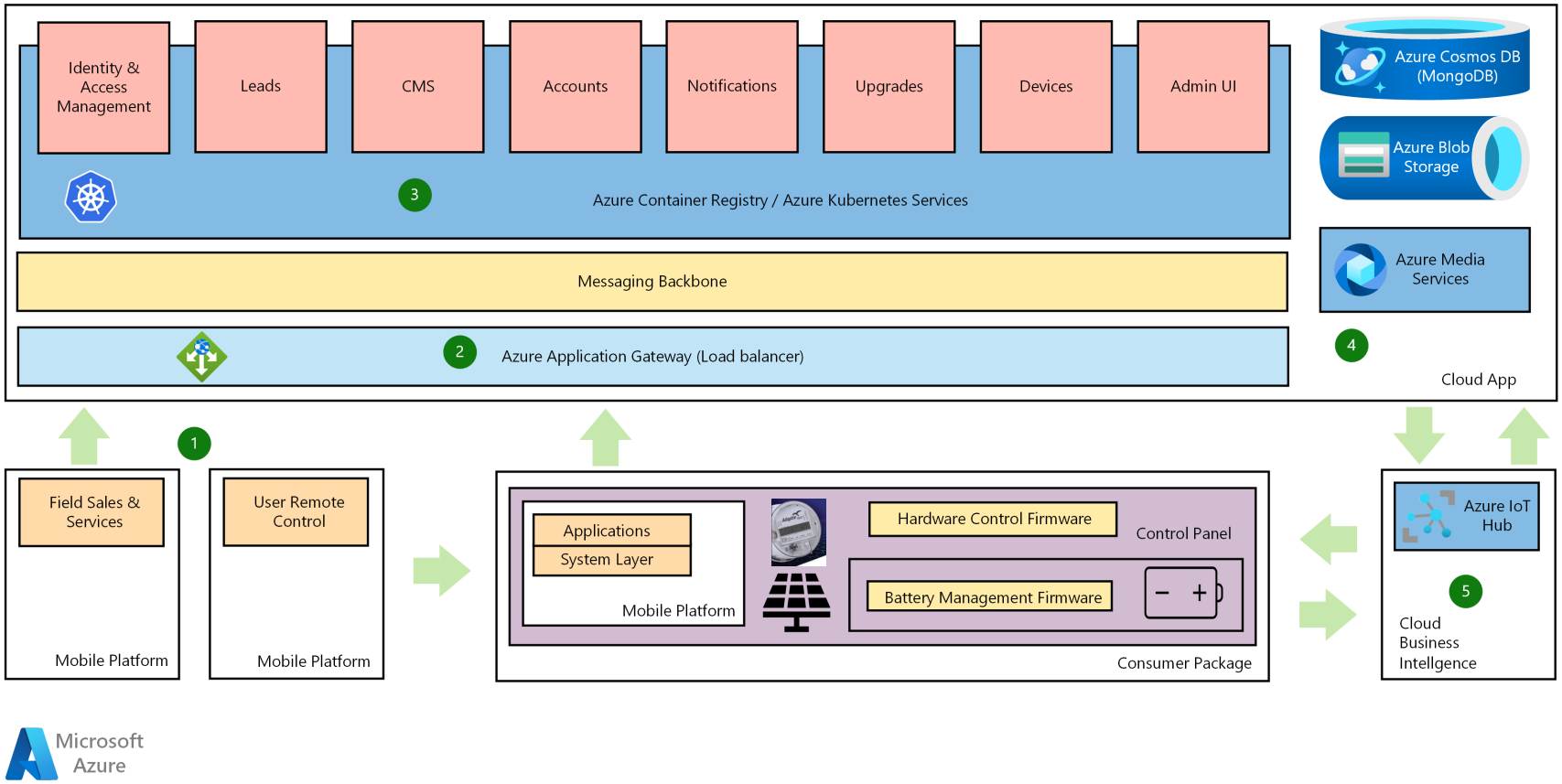


Large Language Models



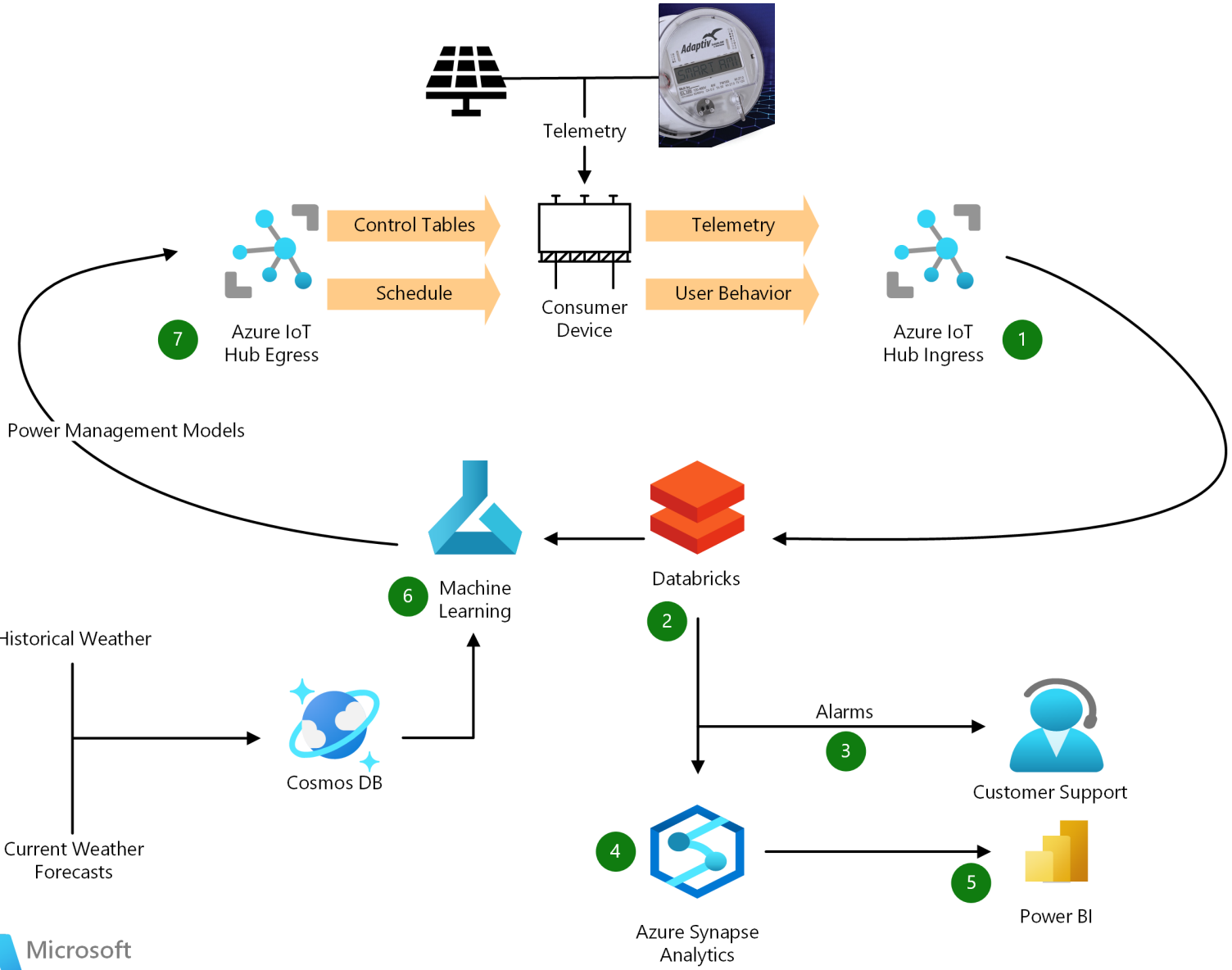
Retrieval Augmented Generation (RAG)

PREDICTIVE MAINTAINENCE



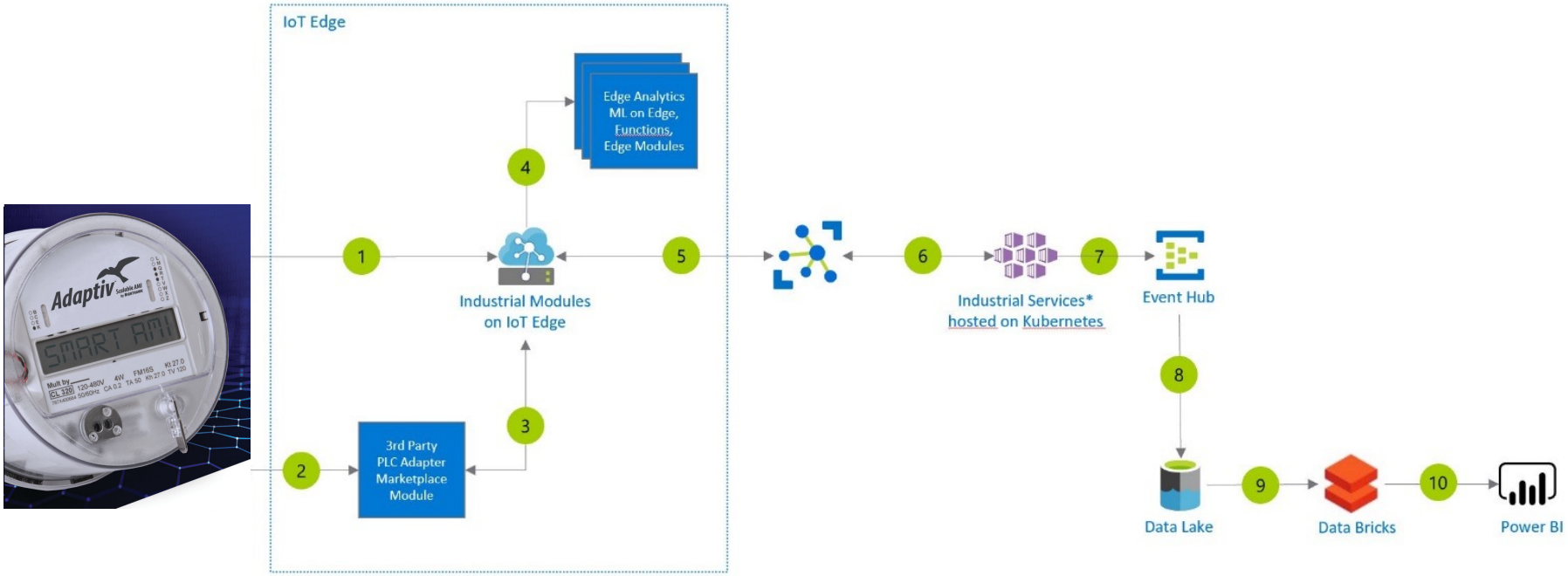
Microsoft Azure

PREDICTIVE MAINTAINENCE



tescometering.com

PREDICTIVE MAINTAINENCE



WHAT'S NEXT

tescometering.com

THANKS