



# Implications of A.I. and Data Analytics on Investing

Chris Liedtke, Head of Data Science

# Introduction

Last time I was near Jacksonville...



2. Implications of A.I. and Data Analytics on Investing

# Implications of A.I. and Data Analytics on Investing

- Investing is a game of making educated bets about the future
- Analytics bolsters conviction in bets by using statistical evidence
- Evidence in quasi-efficient markets exposes efficiency gap opportunities
- Statistical evidence can inform investment diversification & bet sizing
- Modern data systems significantly reduce “time to insight”

# Data Growth

5900 BCE → 2003

**2,884,595 DAYS**

**5 Exabytes of information  
created  
between the  
dawn of civilization  
through 2003...**



March 28, 2022 →

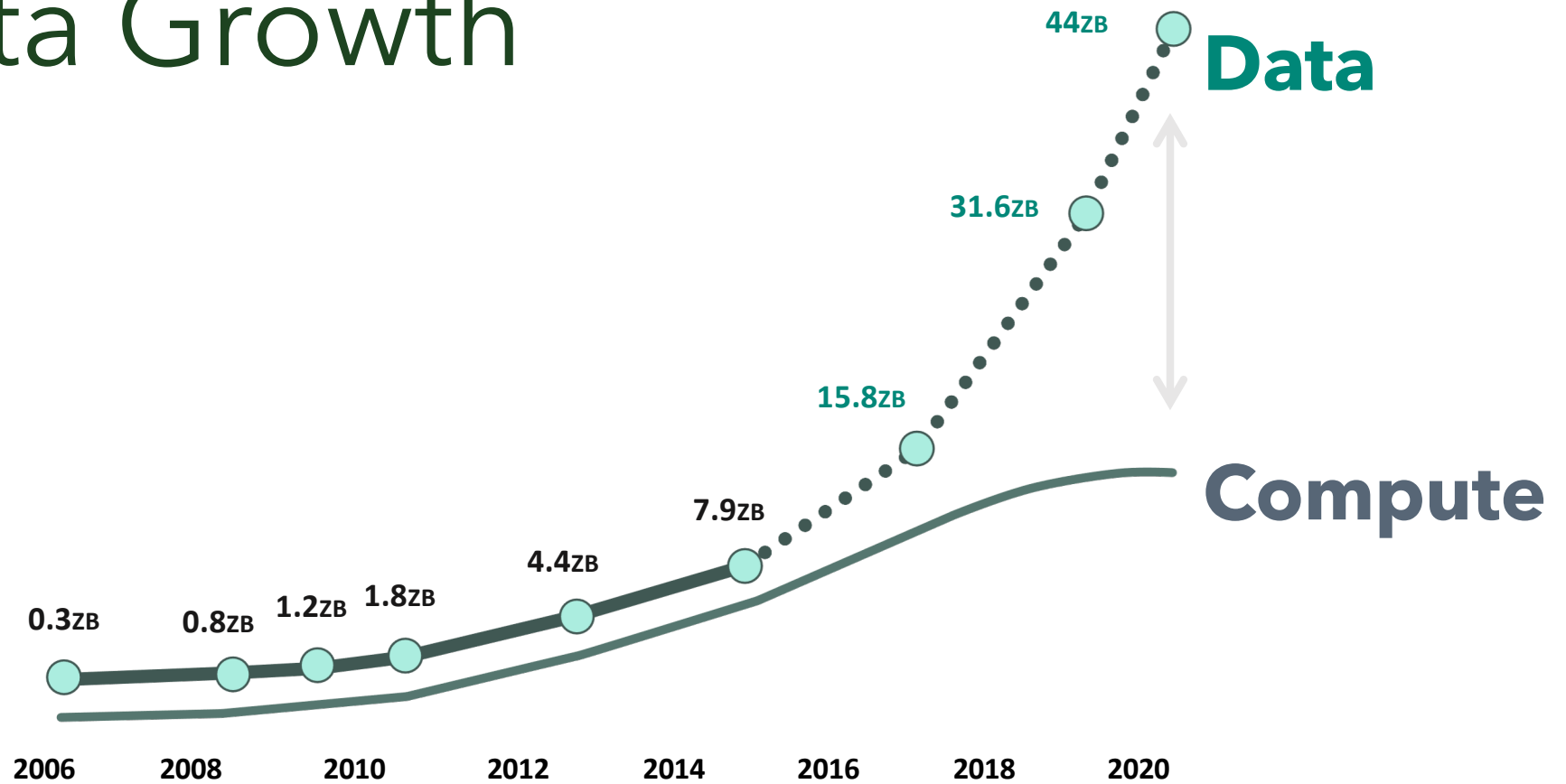
March 30, 2022

**2 DAYS**

**...5 Exabytes of  
information created  
every 2 days.**

— Eric Schmidt (ex-CEO of Google)

# Data Growth



Source: Coughlin, T. (2018, November 27). 175 Zettabytes By 2025. Forbes.

5. Implications of A.I. and Data Analytics on Investing

# Analytics 2.0

## The Next Generation of Analytics



Machine learning is the ***“Field of study that gives computers the ability to learn without being explicitly programmed.”***

– Arthur Samuel





## 7. Implications of A.I. and Data Analytics on Investing

# The RMS Titanic Disaster

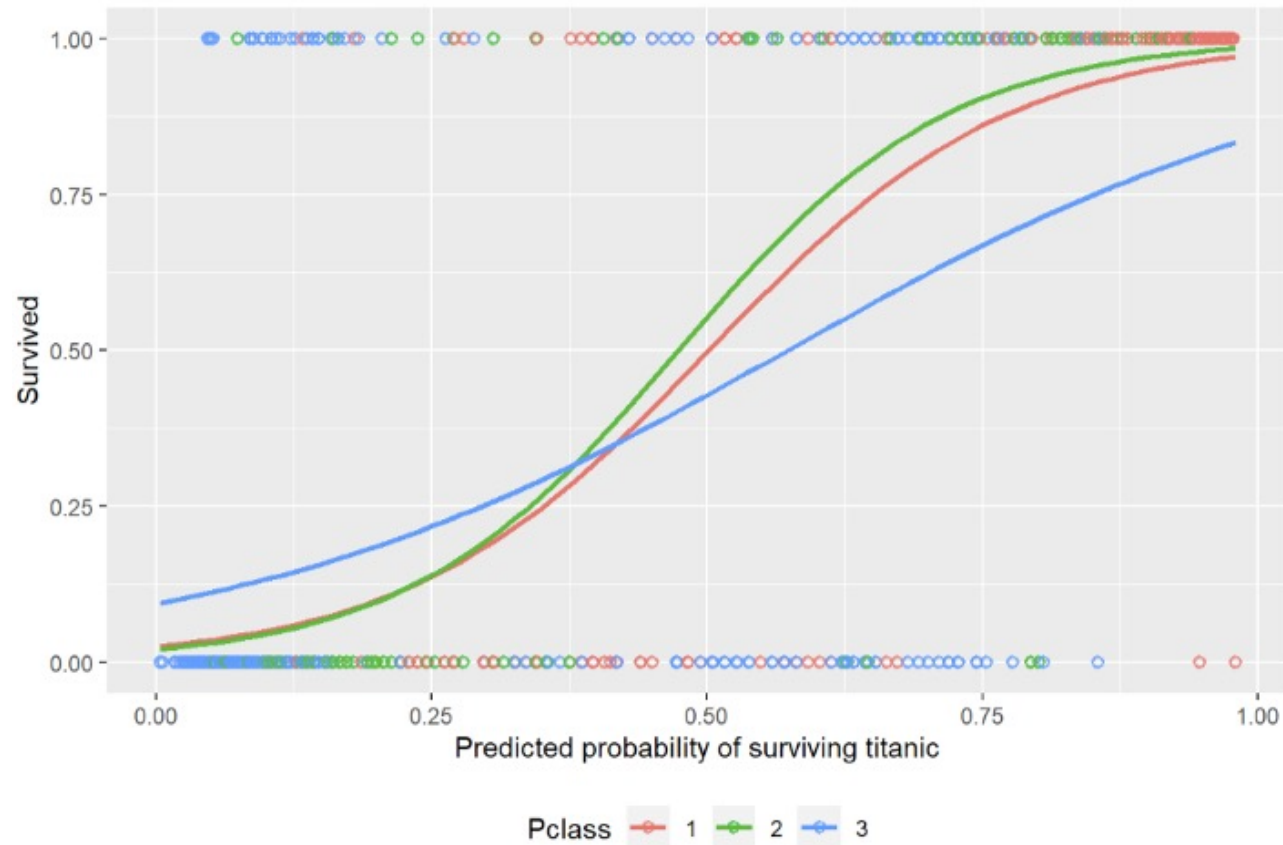
## A Case Study in Analytics

- April 15th, 1912
- Out of 2,224 passengers, 712 survived
- Research question:  
What can we learn from the data about survival?



Class	Last Name	Gender	Age	Family Members	Ticket Price	Departure Port	Survived (Binary)
3rd	Braund	Male	22	1	\$7.25	Southampton	0
1st	Cummings	Female	38	1	\$71.28	Cherbourg	1
3rd	Heikkinen	Female	26	0	\$7.93	Southampton	1
1st	Futrelle	Female	35	1	\$53.10	Southampton	1
3rd	Allen	Male	35	0	\$8.05	Southampton	0
1st	McCarthy	Male	54	0	\$51.86	Southampton	0
3rd	Palsson	Male	2	4	\$21.08	Southampton	0
3rd	Johnson	Female	27	2	\$11.13	Southampton	1
2nd	Nasser	Female	14	1	\$30.14	Cherbourg	1
1st	Bonnell	Female	58	0	\$26.55	Southampton	1
3rd	Rice	Male	2	4	\$29.12	Queenstown	0
2nd	Williams	Male	34	0	\$13.00	Southampton	1
3rd	Vander Planke	Female	31	1	\$18.00	Southampton	0
3rd	Asplund	Male	40	0	\$15.74	Southampton	1
2nd	Hewlett	Female	55	0	\$16.00	Southampton	1

## 9. Implications of A.I. and Data Analytics on Investing



$$\text{Probability of Survival} = e^{(a + b_{\text{Class}} \times \text{Ticket Class} + b_{\text{Age}} \times \text{Age} + b_{\text{Gender}} \times \text{Female})}$$

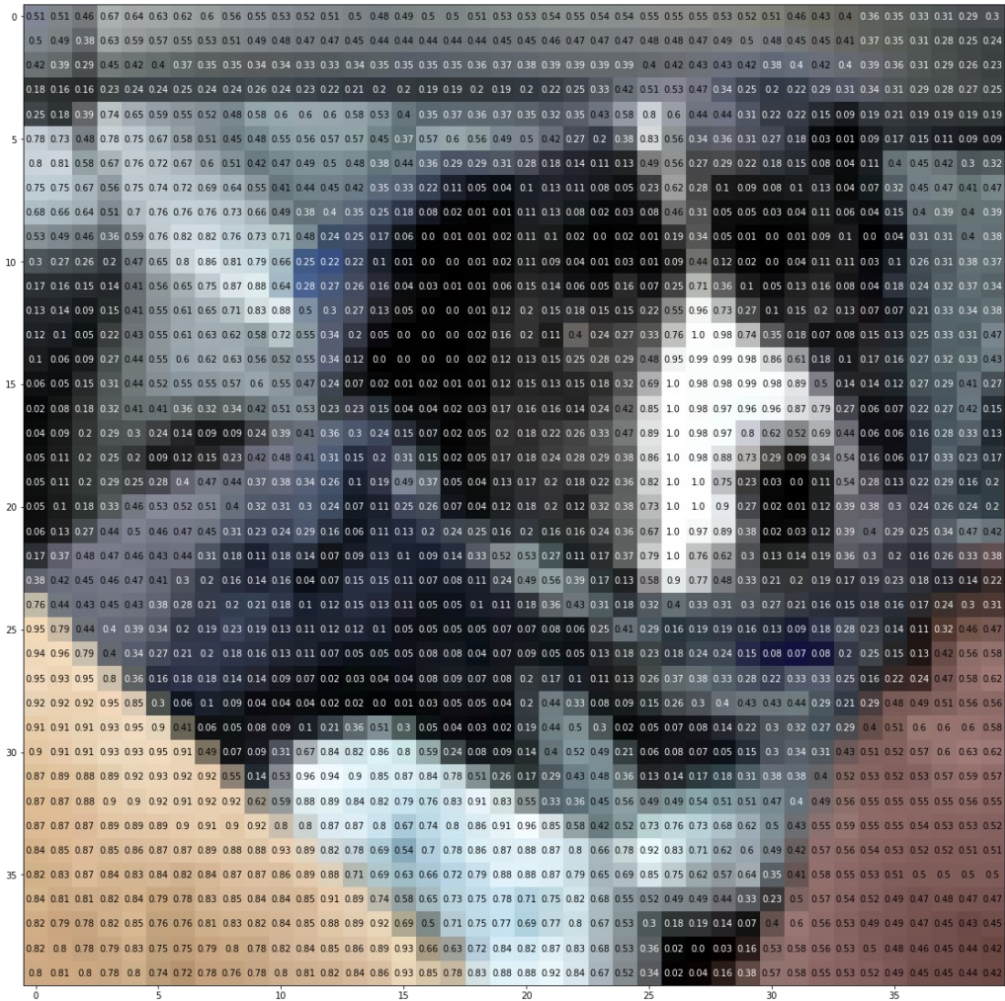
Source: Tan, A. Logistic Regression using Titanic Data. <https://rpubs.com/zheshuen/596809>.

10. Implications of A.I. and Data Analytics on Investing

# The RMS Titanic Disaster

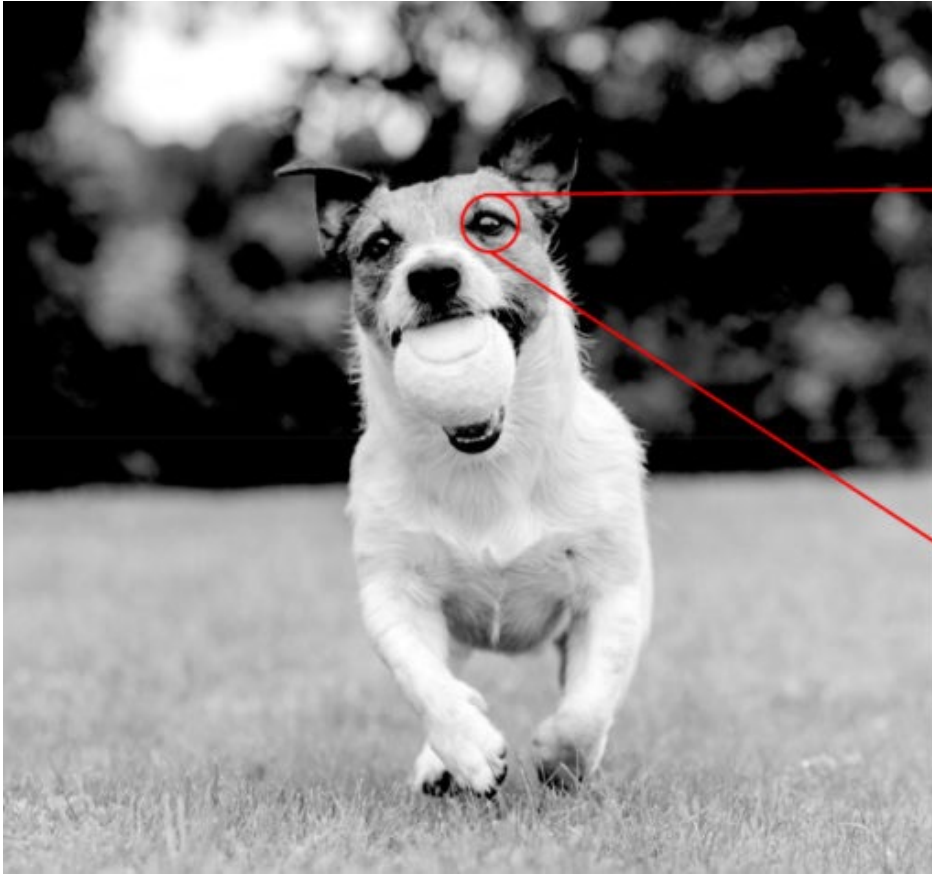
## A Case Study in Analytics

- Women had 10x higher survival odds than men.
- 1st class had 4.5x higher survival odds than 3rd class.
- 2nd class had 2.5x higher survival odds than 3rd class.
- Each decade of age reduced survival odds by 26%.
- Cherbourg boarding increased odds compared to Southampton.
- Queenstown boarding had similar survival odds to Southampton.
- Higher ticket price slightly increased survival odds.



## 12. Implications of A.I. and Data Analytics on Investing

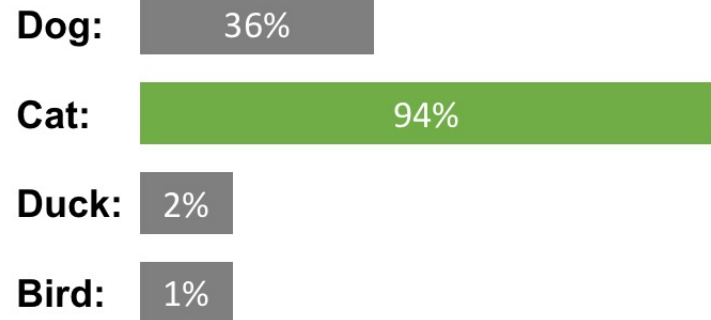
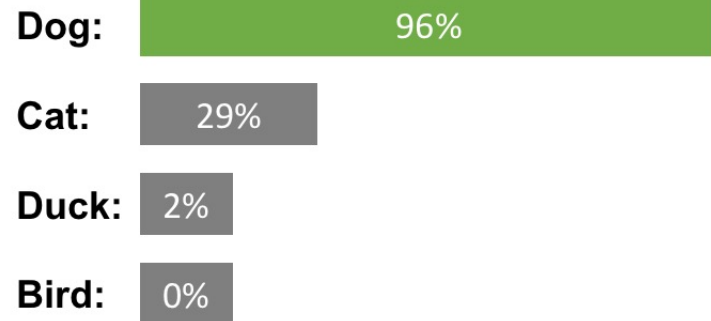
Source: Great Learning. <https://www.mygreatlearning.com/>



```
[208, 126, 83],  
[207, 124, 82],  
[210, 126, 84]],  
[[112, 143, 166],  
[127, 158, 181],  
[145, 176, 199],
```

Source: Great Learning. <https://www.mygreatlearning.com/>

### 13. Implications of A.I. and Data Analytics on Investing

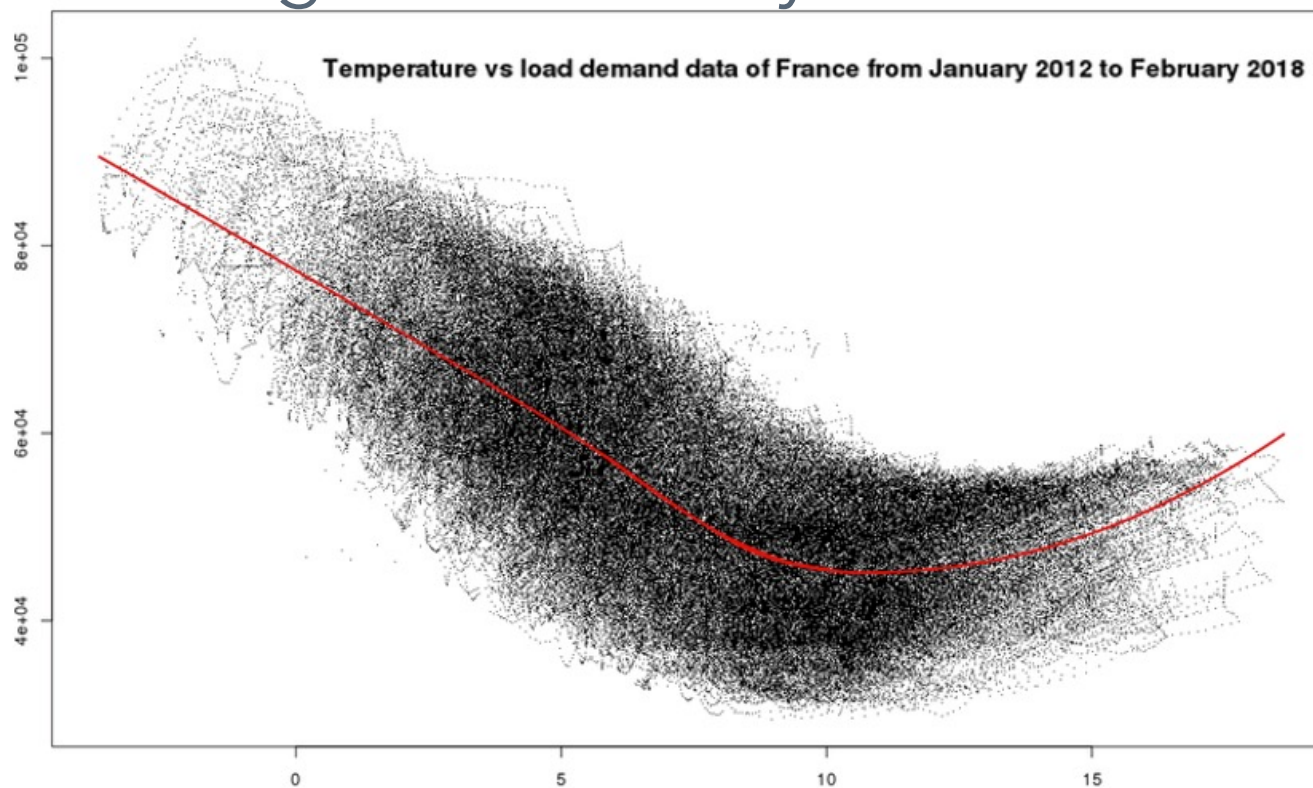


Source: *Deep Learning for Computer Vision*. O'Reilly Media

14. Implications of A.I. and Data Analytics on Investing

# Forecasting 2.0

## Climbing the Causality Chain



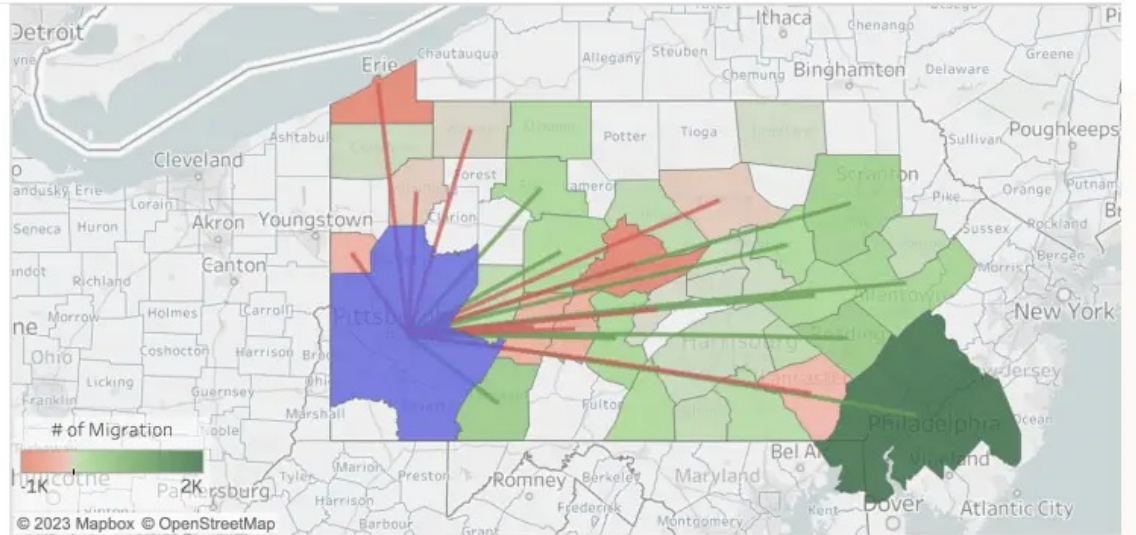
Source: Nagbe, K., Cugliari, J., & Jacques, J. (2018). Short-Term Electricity Demand Forecasting Using a Functional State Space Model.

### Top Net Migrations To: Pittsburgh, PA

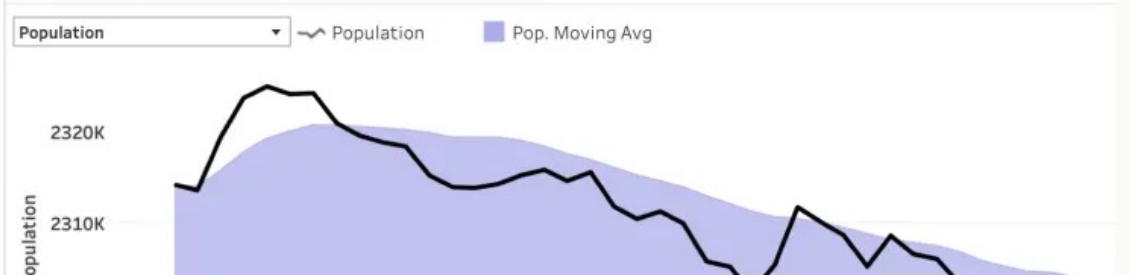
Origin Region	Migration	% of Pop.	Median HHI
Philadelphia-Camden-Wilmi..	1.7K	0.07%	\$75K
Reading, PA	0.4K	0.02%	\$66K
Somerset, PA	0.4K	0.02%	\$51K
Scranton--Wilkes-Barre, PA	0.3K	0.01%	\$54K
Allentown-Bethlehem-Easto..	0.3K	0.01%	\$70K
Huntingdon, PA	0.2K	0.01%	\$54K
Pottsville, PA	0.2K	0.01%	\$54K
St. Marys, PA	0.2K	0.01%	\$55K
DuBois, PA	0.2K	0.01%	\$50K
Bloomsburg-Berwick, PA	0.2K	0.01%	\$54K

### Top Net Migrations From: Pittsburgh, PA

Destination Region	Migration	% of Pop.	Median HHI
State College, PA	-0.7K	-0.03%	\$62K
Erie, PA	-0.7K	-0.03%	\$53K
Altoona, PA	-0.2K	-0.01%	\$51K
Johnstown, PA	-0.2K	-0.01%	\$48K
New Castle, PA	-0.2K	-0.01%	\$50K



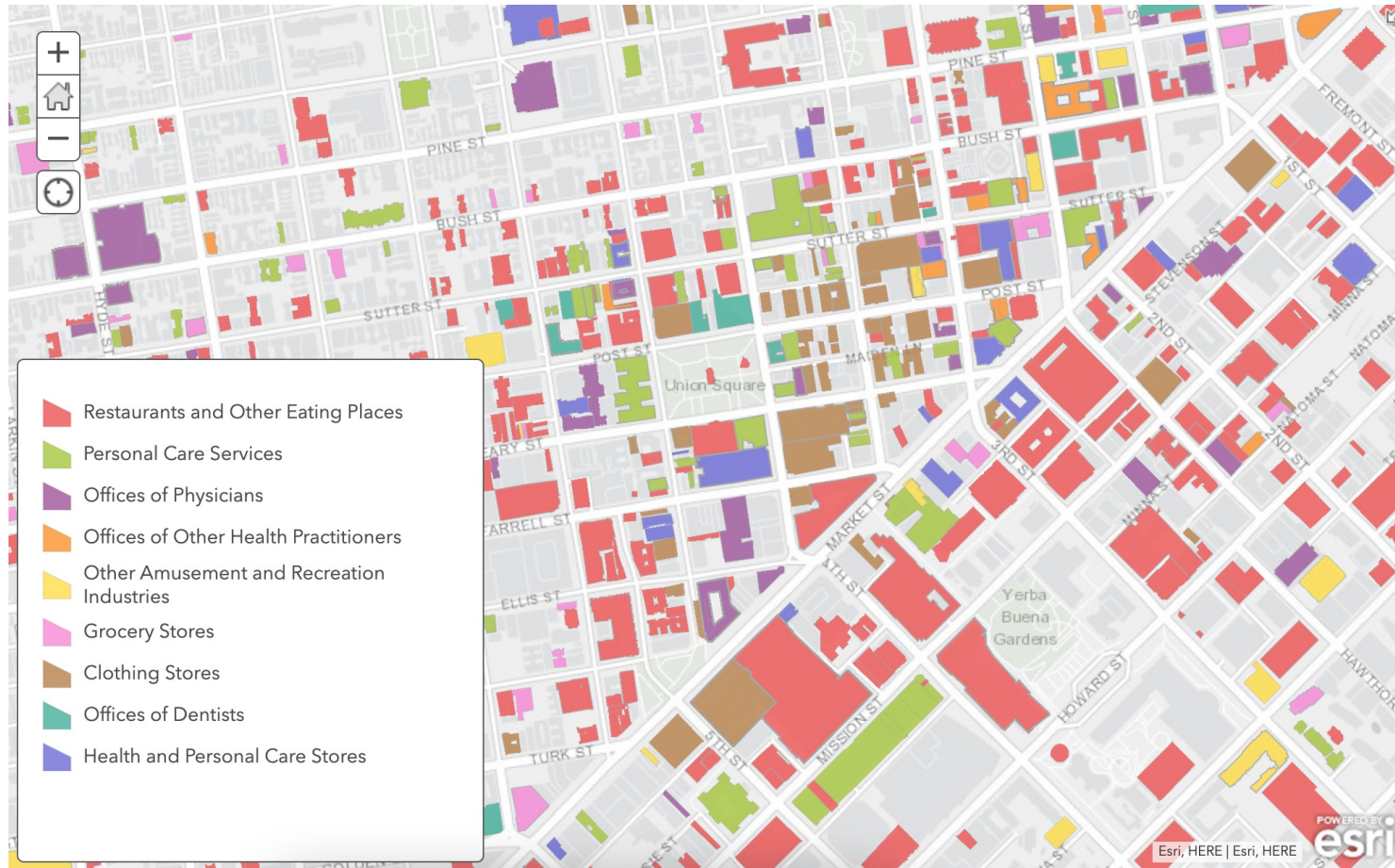
### Population: Pittsburgh, PA Metro Area Migration Analysis



Source: Placer.ai - Location Analytics & Foot Traffic Data. Retrieved from <https://www.placer.ai/>.

## 16. Implications of A.I. and Data Analytics on Investing



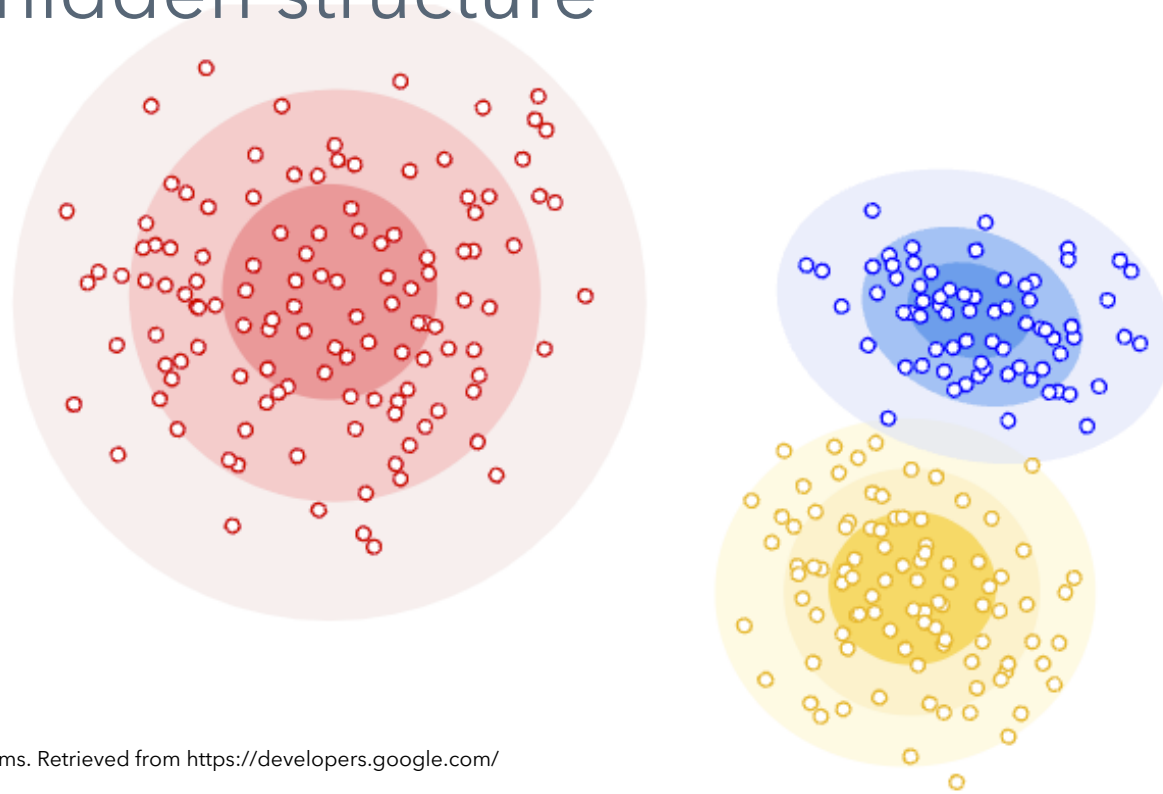


Source: SafeGraph. Data Sourcing Process. Retrieved from <https://www.safegraph.com/>.

## 17. Implications of A.I. and Data Analytics on Investing

# Unsupervised AI/ML

Discovering hidden structure

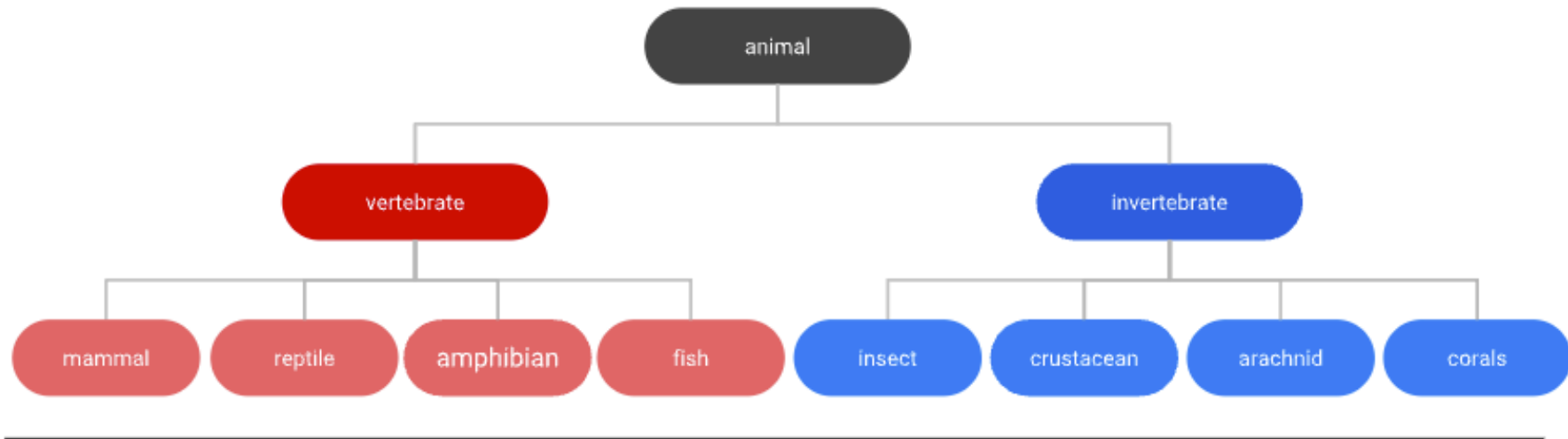


Source: Google Developers. Clustering Algorithms. Retrieved from <https://developers.google.com/>

18. Implications of A.I. and Data Analytics on Investing

# Unsupervised AI/ML

Discovering hidden structure

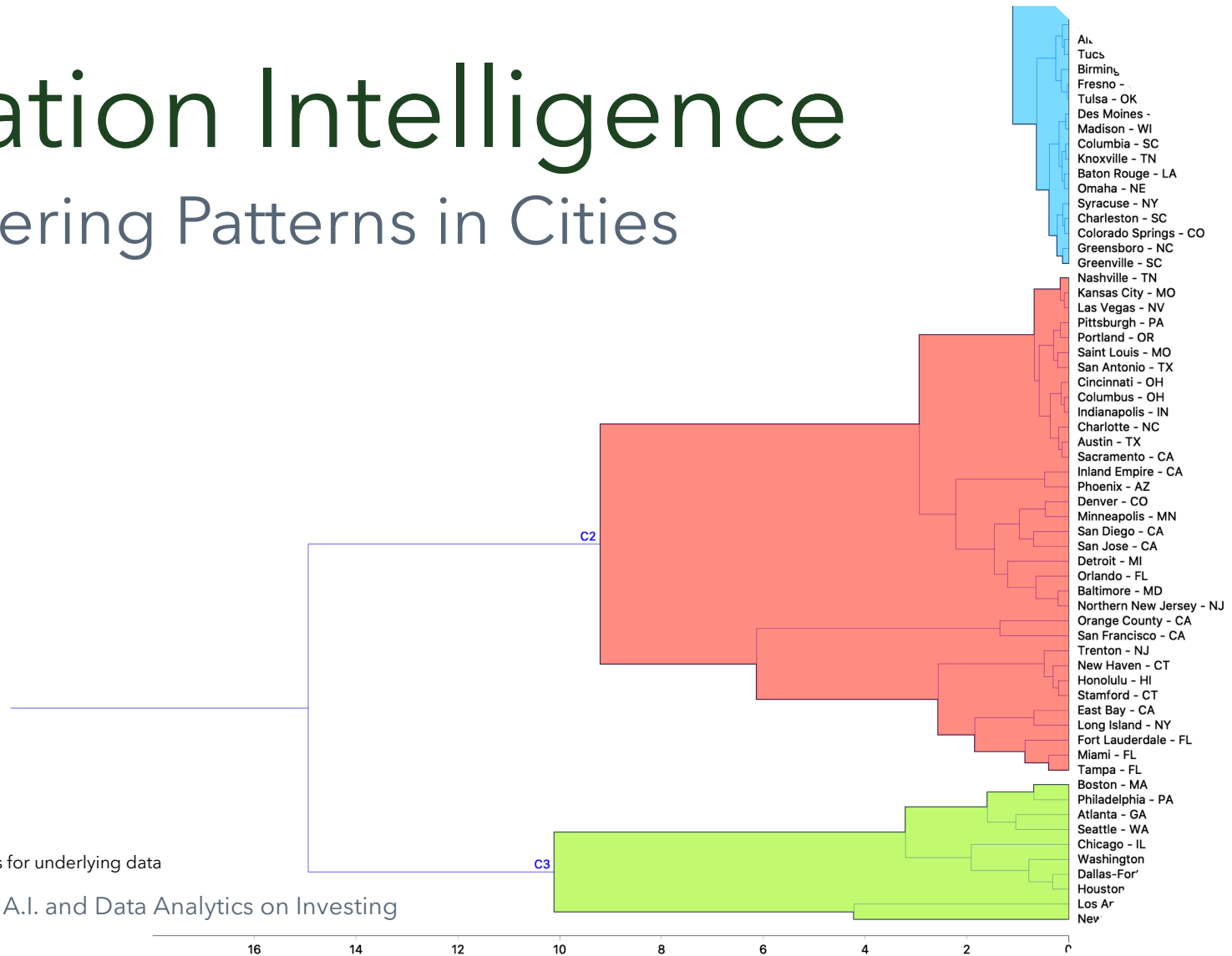


Source: Google Developers. Clustering Algorithms. Retrieved from <https://developers.google.com/>

19. Implications of A.I. and Data Analytics on Investing

# Location Intelligence

## Discovering Patterns in Cities



Source: Moody's Analytics for underlying data

20. Implications of A.I. and Data Analytics on Investing

# Location Intelligence

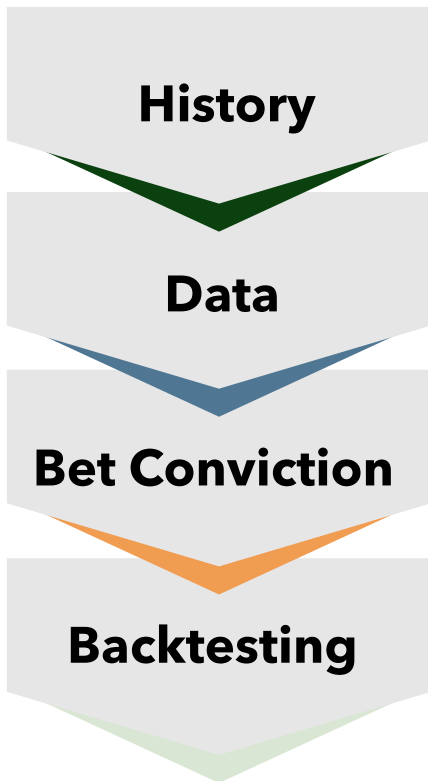
Discovering patterns that improve diversification

City A	City B	Correlation
Tucson, AZ	Colorado Springs, CO	99.9794%
Fayetteville, NC	Fort Knox, KY	99.9915%

Source: Moody's REIS & Costar for underlying data

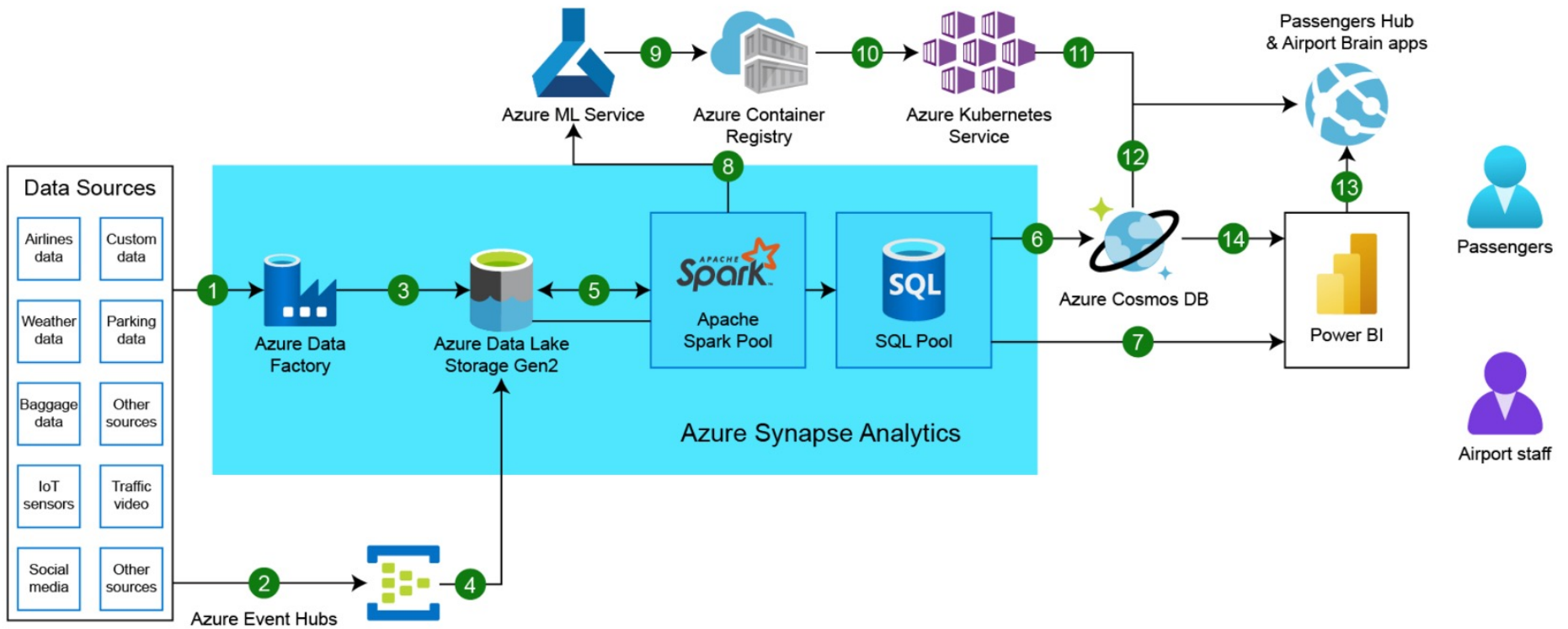
21. Implications of A.I. and Data Analytics on Investing

# A.I. Investment Case Study



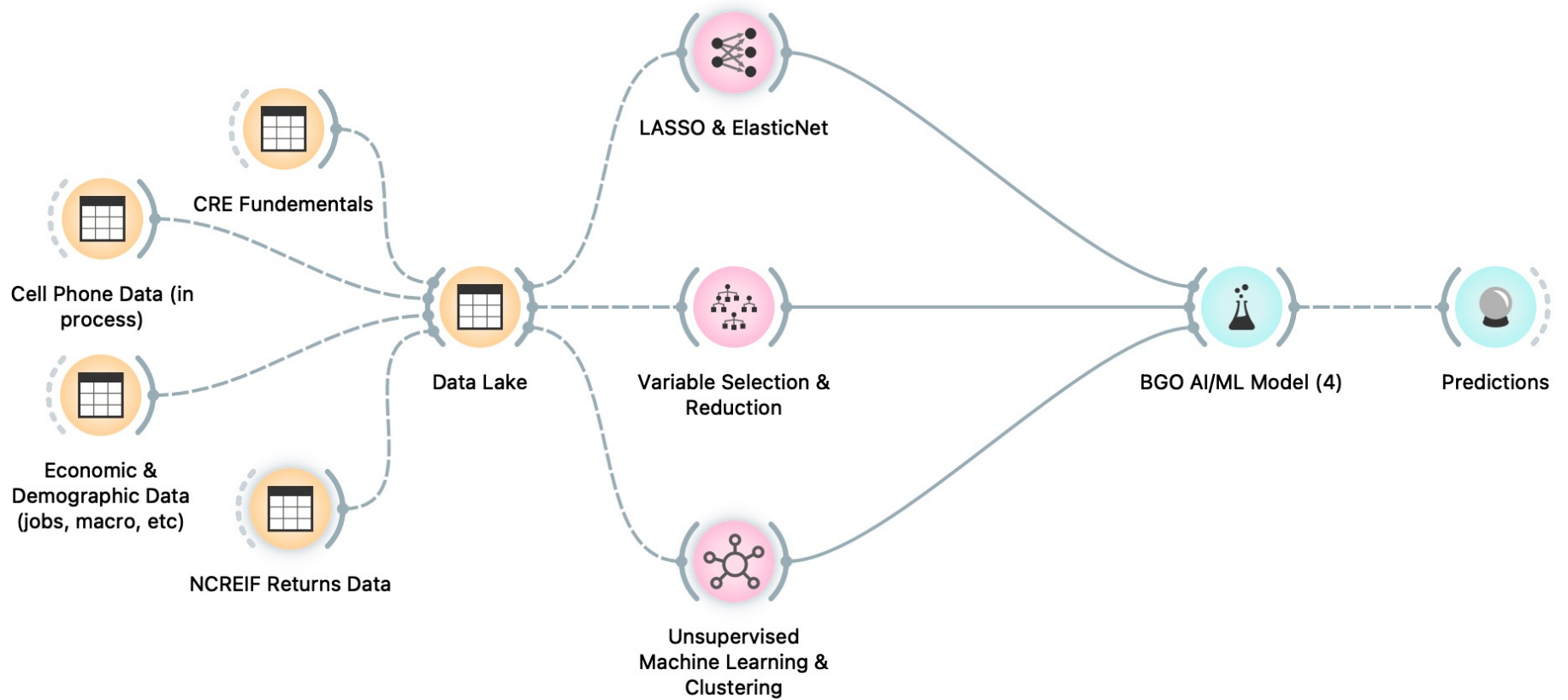
- Models ~23 years in various increments
- 32,000 variables
- Predicts probability of outperformance (e.g., ChatGPT)
- ~600 models vote on the future





Source: <https://learn.microsoft.com/en-us/azure/architecture>

### 23. Implications of A.I. and Data Analytics on Investing



## 24. Implications of A.I. and Data Analytics on Investing



# CRE Investment Case Study

## Apartment Market in Tampa, FL

**Performance:** Ranked #**24** with a predicted 82% probability of top-quartile rent growth

---

**Population:** Ranked #8 for net migration

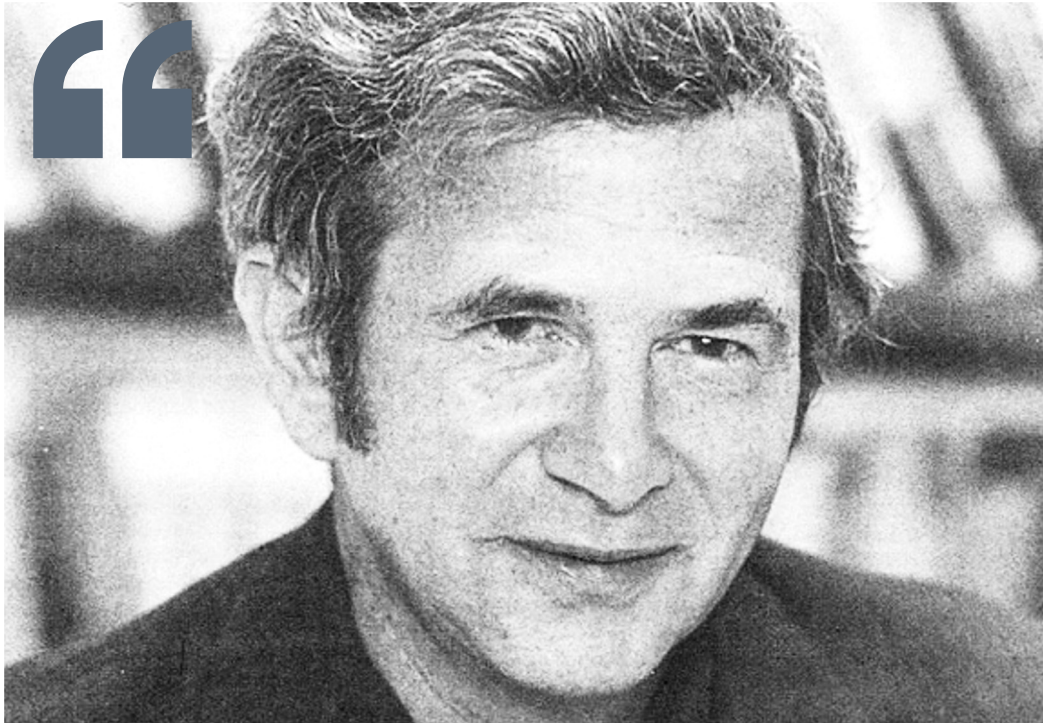
---

**Demand:** Ranked #15 for mortgage application activity

---

**Age:** Top quartile for % of the population 65+





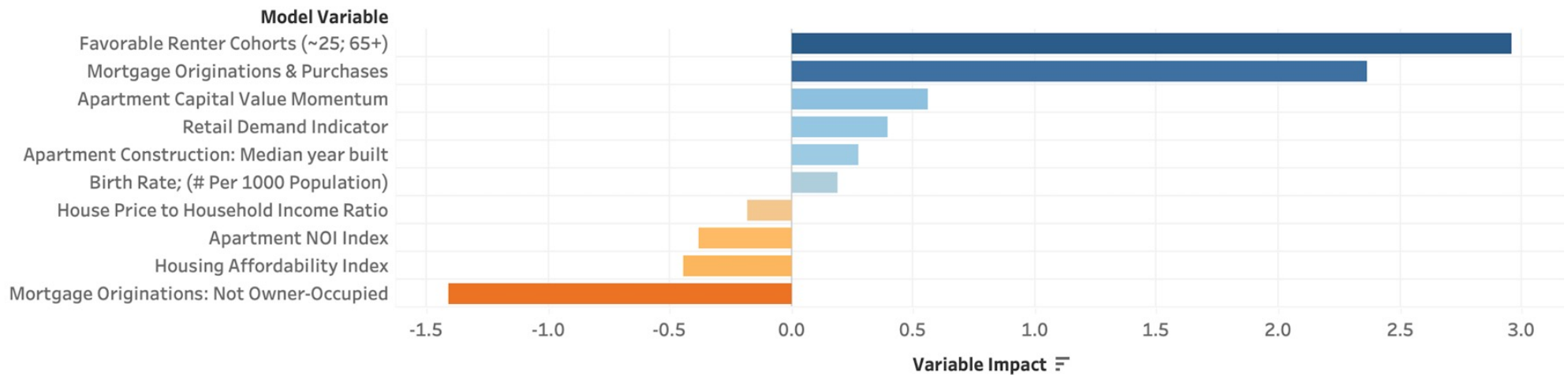
*The purpose of models is not to fit the data but to sharpen the question.*

– Dr. Samuel Karlin, Stanford  
Mathematics



# Explainable AI (XAI)

## Understanding the Black-Box

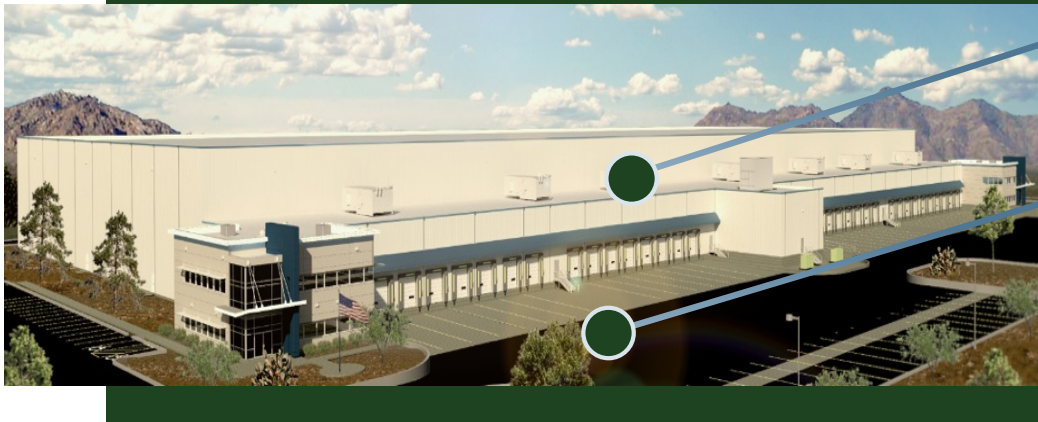


Source: Moody's Analytics & Moody's REIS for modeling data

27. Implications of A.I. and Data Analytics on Investing

# CRE Investment Case Study

**Top Performer:** Ranked #50 out of #390 modeled markets with supply arbitrage model.



**Supply Chain Characteristics:** Model detected proximity to:

- Fruit, vegetable, meat, and dairy manufacturing
- Air, rail, and trucking infrastructure.

**Data Advantage:** Proprietary Database enables deal, market, and asset intelligence + AI/ML Models

Source: Moody's Analytics/REIS, CoStar, & US Census for underlying data

28. Implications of A.I. and Data Analytics on Investing

# Implications of A.I. and Data Analytics on Investing

- Investing is a game of making educated bets about the future
- Analytics bolsters conviction in bets by using statistical evidence
- Evidence in quasi-efficient markets exposes efficiency gap opportunities
- Statistical evidence can inform investment diversification & bet sizing
- Modern data systems significantly reduce “time to insight”