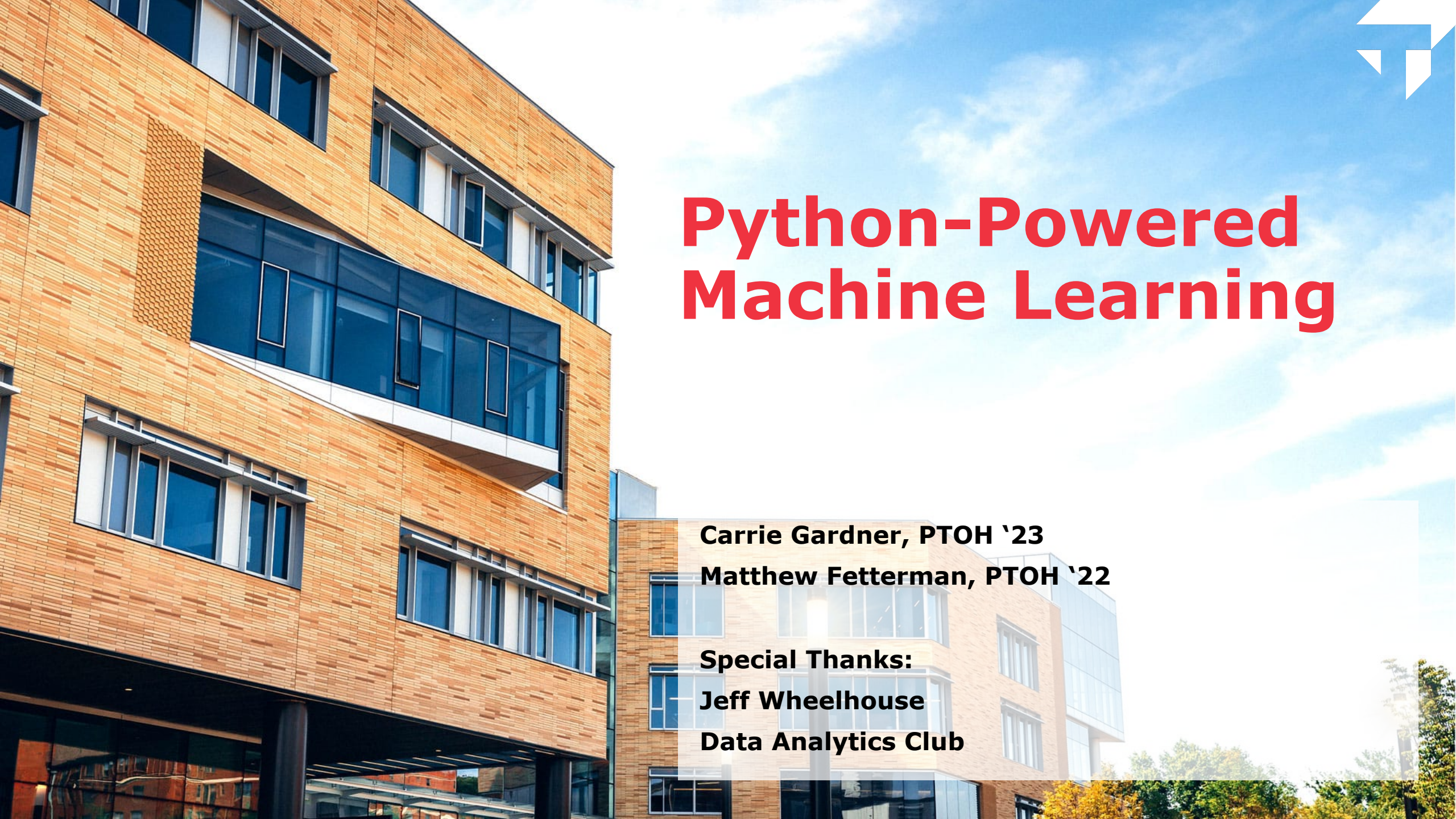

Python-Powered Machine Learning

Carrie Gardner, PTOH `23

Matthew Fetterman, PTOH `22

Special Thanks:

Jeff Wheelhouse

Data Analytics Club

A Little Background on Us

Carrie Gardner

- Team Lead – Insider Risk @ Software Engineering Institute, CMU
- Social Science & Information Science Education
- 5+ years using python and working on analytics projects
- Proud Python Evangelist 😁

Matthew Fetterman

- Army Officer
- Agriculture & Plant/Soil Science Education
- 10+ years managing analytics projects

Workshop Roadmap

- Logistics
- What is Machine Learning?
- Why Python?
- Business Applications
- Interactive Tutorial

Timing:
~30 Minutes Lecture
~5-10 Minute Break
~80 Minutes
Interactive Coding

Logistics

- This workshop assumes
  - Attendees have little experience with machine learning
  - Attendees have little experience using python
  - **Everyone** can learn to code (no CS background required!)
- **PLEASE raise your hand and ask questions!**
- Takeaways:
  - **Confidence** to start machine learning with python
  - **Knowledge** of ML and data analytics capabilities with python
  - **Scaffolding** to jump-start a python-powered analytics project

What is Machine Learning?

Let’s Frame the Opportunity

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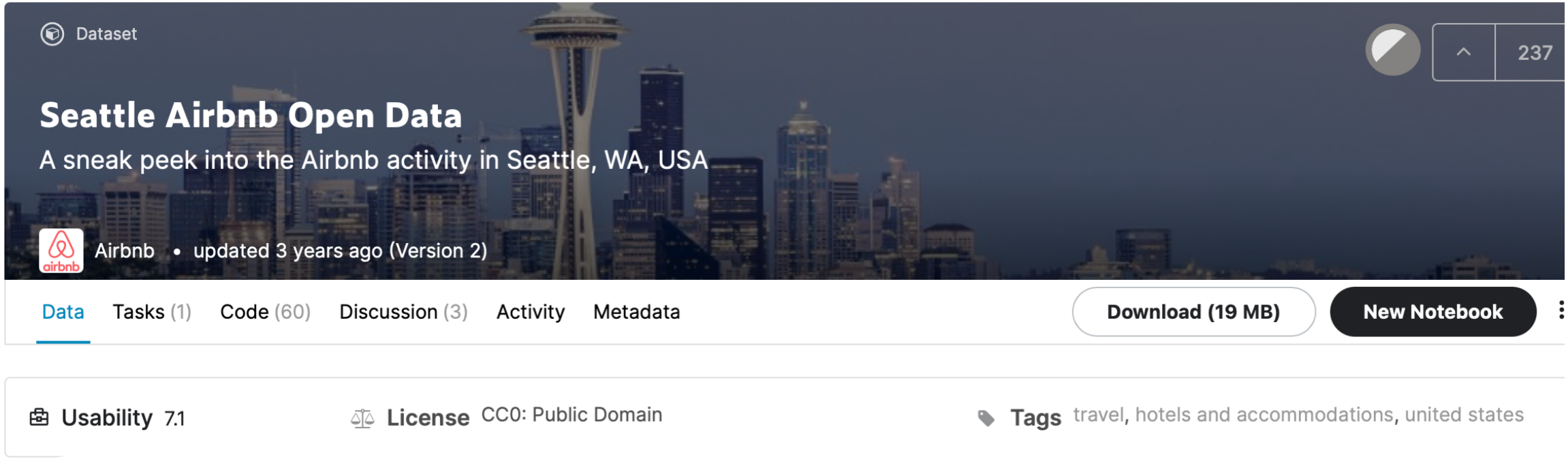

- Can we **forecast** and **predict** prices?
- Can we **parse** and **glean insights** from reviews?
- Can we **segment** listings into groups?

kaggle

What is Machine Learning?

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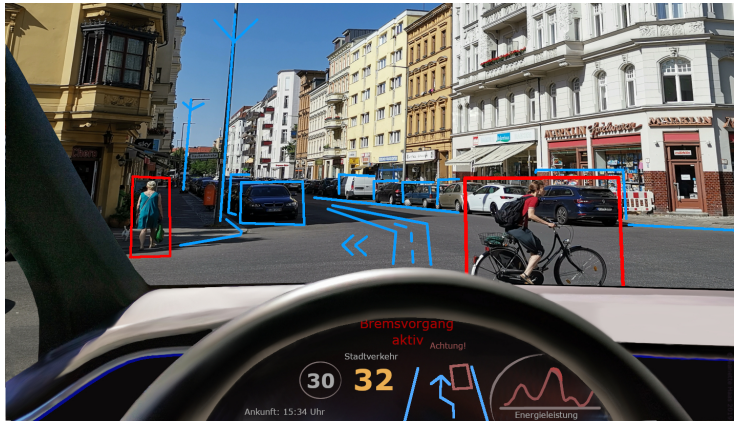
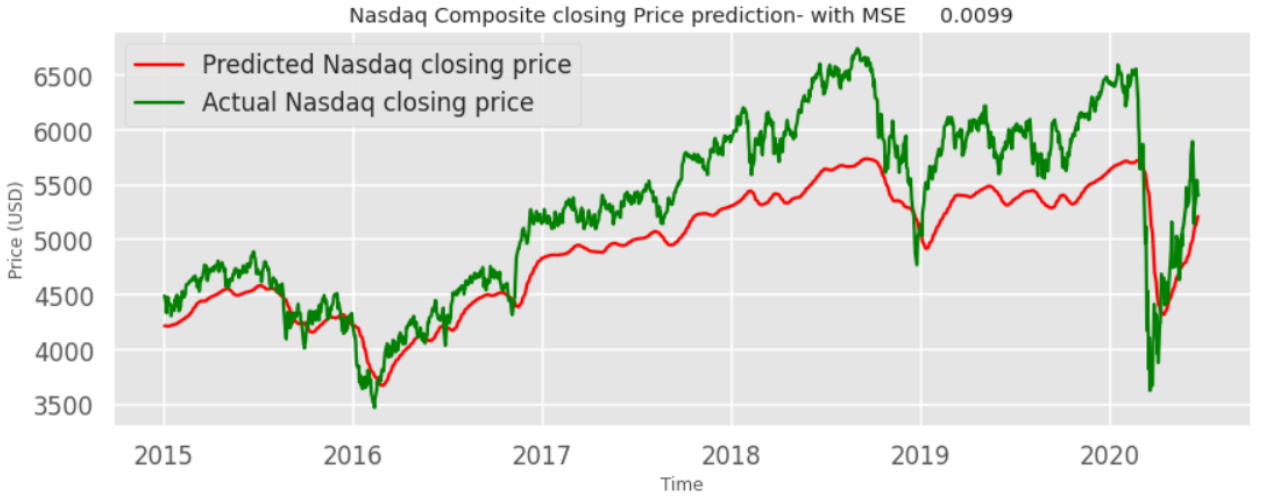
Machine Learning (ML) is a data science technique that learns from existing data to forecast future behaviors, outcomes, and trends



Forms

- **Supervised**
- **Unsupervised**
- Semi-supervised
- Reinforcement/Active



Supervised Learning

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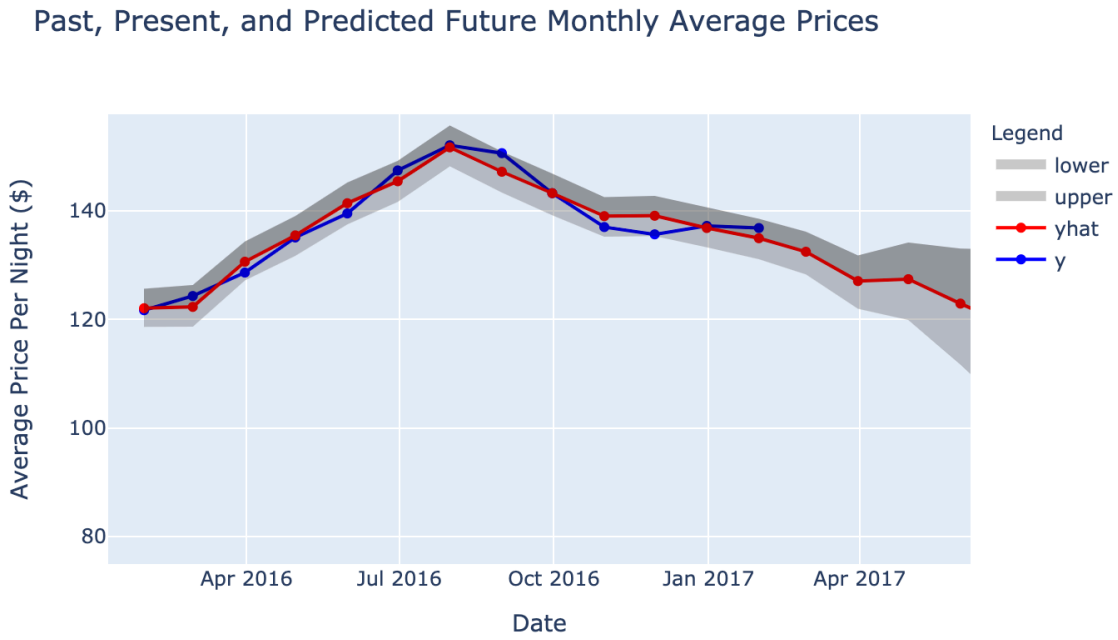
Supervised ML models are developed by training algorithms on *labeled* data to understand the relationship between the features and the label

- Classification
- **Regression**



Forecast Daily Listing Prices

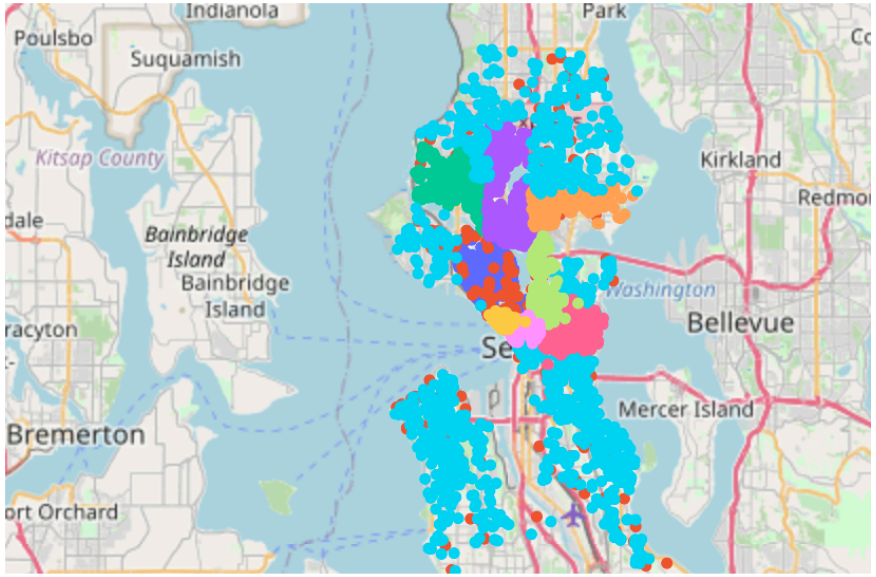
- Modeling using FB's Prophet Library
- Visualization using Plotly

Unsupervised Learning

Unsupervised ML models are developed by training algorithms on *unlabeled* data to find relationships amongst variables

- **Clustering**
- Association

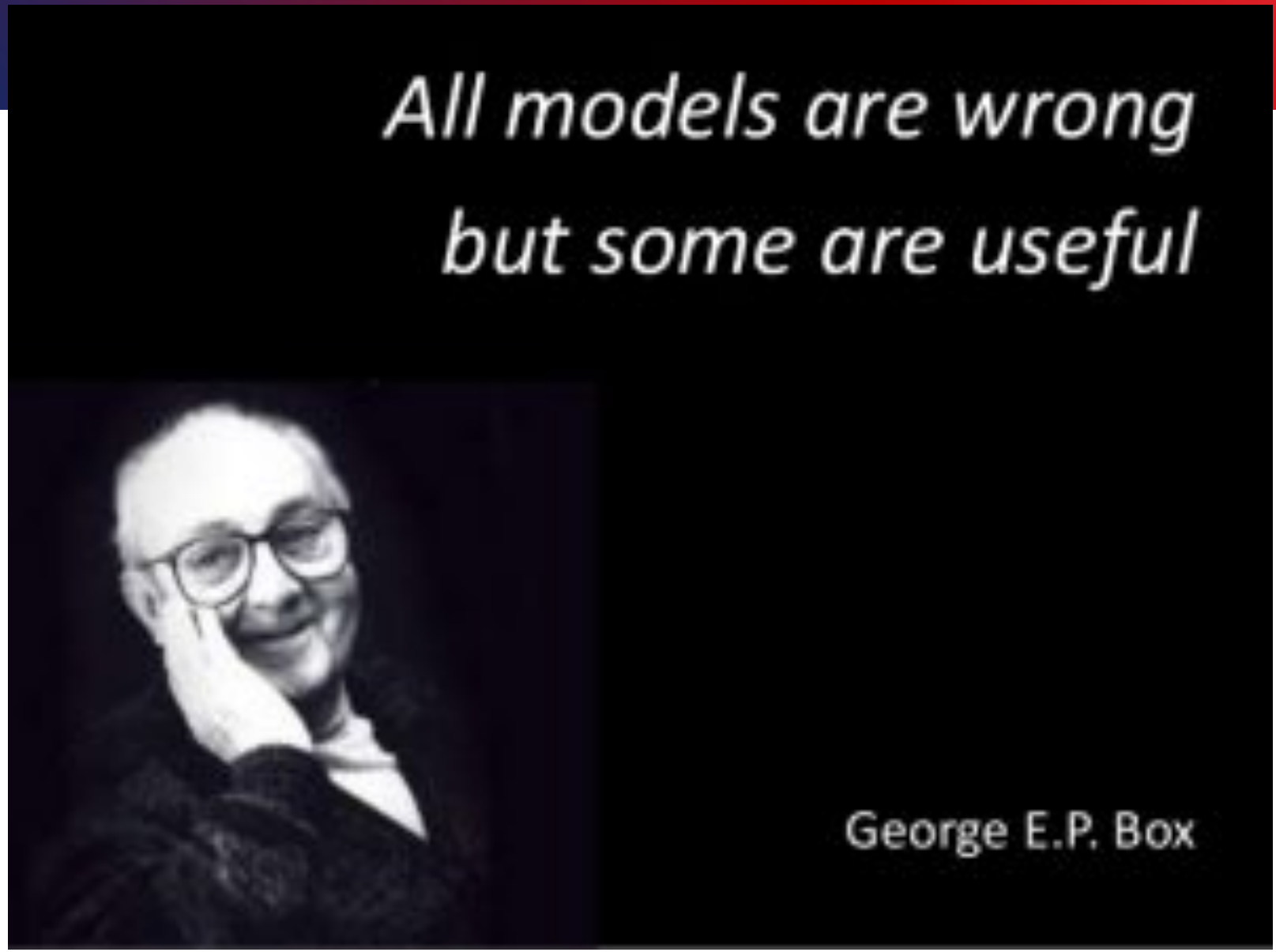
K-Means Clustering of AirBnB Spaces



Cluster Listings into Neighborhoods

- Modeling using Scikit-Learn
- Visualization using Plotly

Remember:
a machine learning model is designed to represent the problem you are studying, and it is not a perfect reflection of the problem



Model Training & Evaluation

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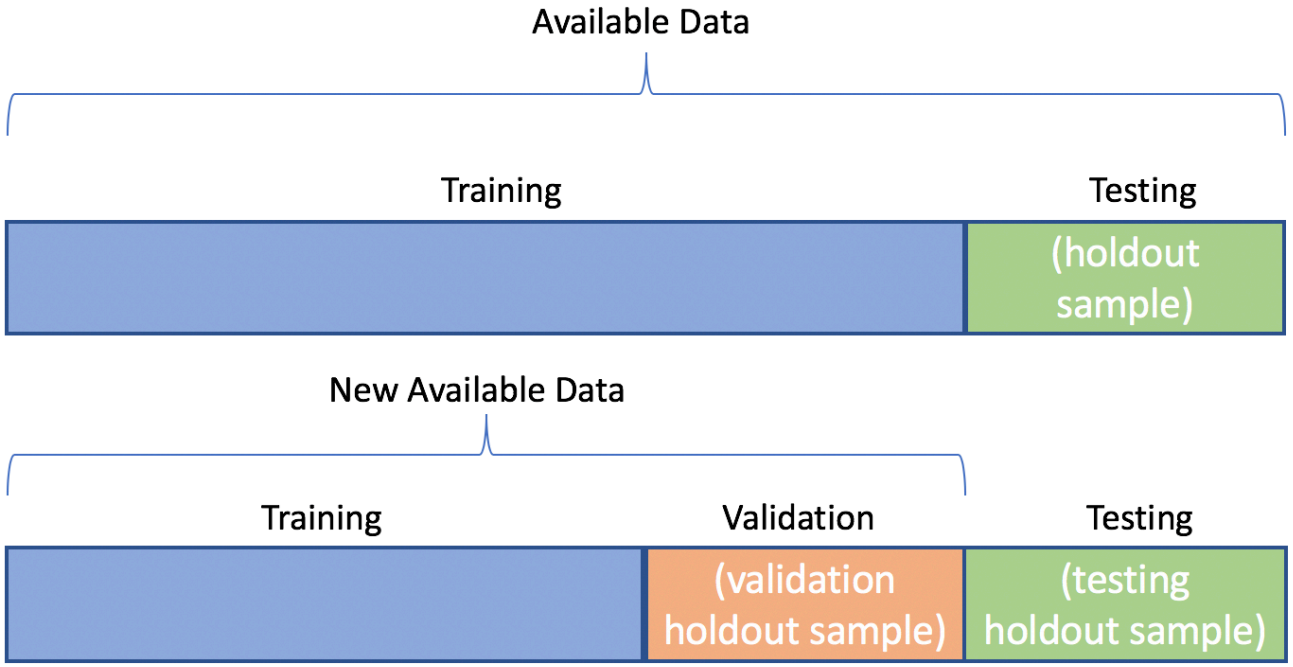
Training & Evaluation (T&E)

- Training: data used to fit (train) the model (typically accounts for 70-90% of all data)
- Evaluation (Test): data used to at the end of fitting to measure how robust the model is to handling other data
- Holdout (Validation): data used to assess the performance of the model after the model has been fitted, tested, and is ready for deployment



High-Level ML Workflow

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BLUF

- What is the purpose?
- What is the end state goal?
- What are the requirements vs. the requests?

Problem Formation
- What is the goal?
- What are the requirements?

Data Curation
- Collect Data
- Preprocess

Exploratory Analysis
- Learn basic features
- Visualize and discern patterns

Modeling
- Select techniques per Problem Formation
- Train and fit ML pipeline model

Testing & Evaluation
- Iteratively test and evaluate ML model for appropriateness of fit / tune parameters

Integration
- Validate model meets specifications
- Deploy ML tool into production

Considerations

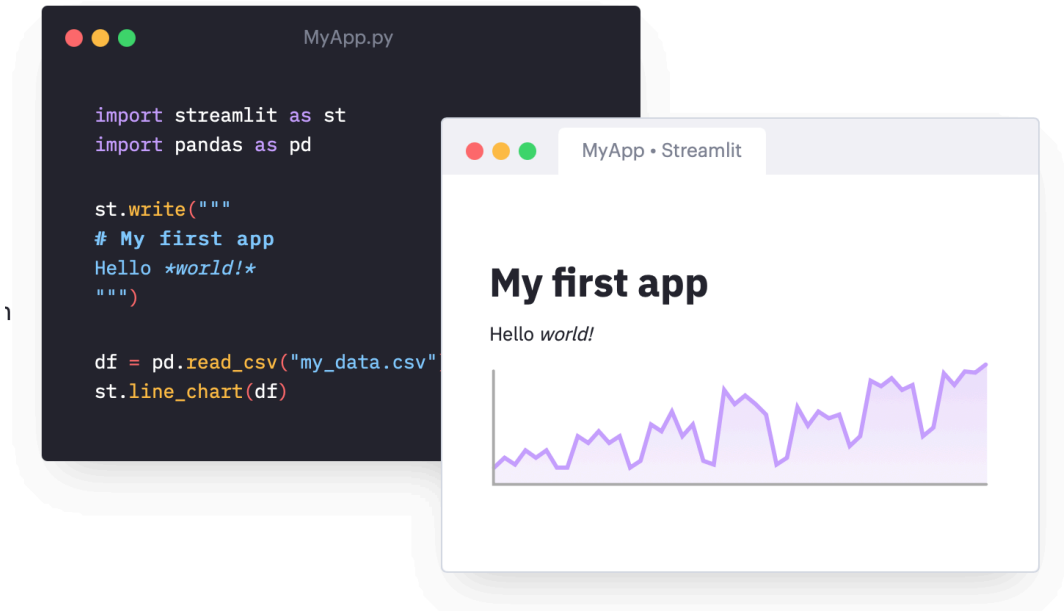
- Product Integration?
- Decision Support Tool or Fully Autonomous?
- Risk Tolerance Requirements ☺

Why Python?

Why Python?

Python is "an interpreted, high-level and general-purpose programming language"

- Versatility
- Code readability
- General and specialized libraries
- Object-oriented design
- **Full data lifecycle support – from Exploratory Analysis to Data Product Development**



Python-Powered Applications

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- Web Development
- Embedded Systems
- Desktop Applications
- Command Line Interfaces (CLI)
- Data Analytics & Machine Learning
  - Curate and model structured and unstructured data
- Scripting

spaCy

neo4j

Keras

statsmodels

scikit learn

pandas

plotly | Dash

Companies that Rely Upon Python

- Google
  - "Python has been an important part of Google since the beginning, and remains so as the system grows and evolves. Today dozens of Google engineers use Python, and we're looking for more people with skills in this language." - Peter Norvig, director of search quality at Google, Inc.
- Facebook
- Instagram (a Django app!)
- Spotify
- Netflix (super Jupyter proponents)
- Dropbox
- Pinterest (Django → Flask)
- Goldman Sachs
- Paypal
- Consumer Financial Protection Bureau
- DHS ☺

JOBS

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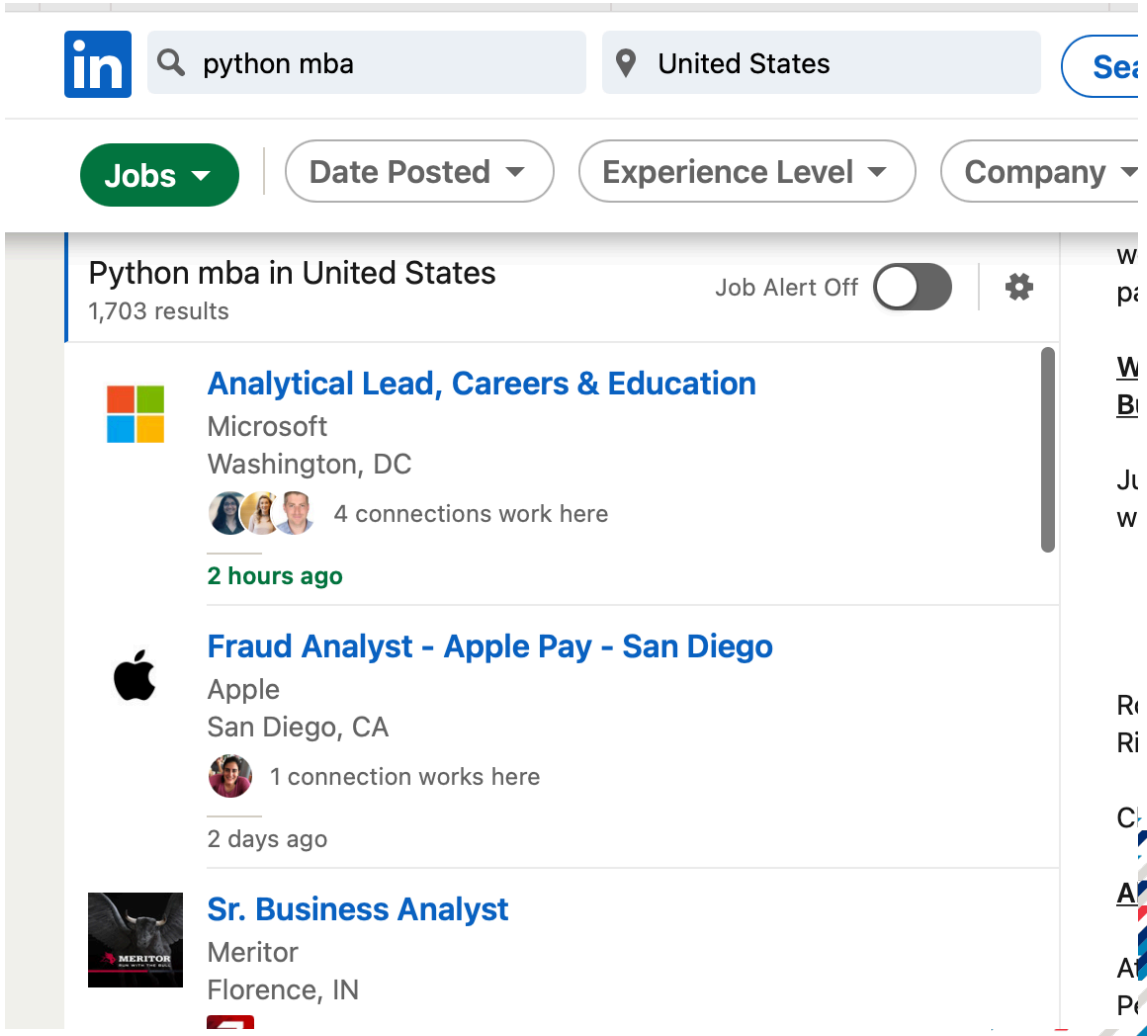
Appreciation of Python + MBA is a powerful combo…

- Business Intel Analyst
- Analytics Lead
- Data Scientist
- People Analytics
- Product Manager
- …



Python-Powered ML Tech Stack

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Analytics

- Scikit-Learn
- Plotly
- Statsmodels, keras, torch, spaCy, etc…

Data Manipulation

- Pandas

Code & Documentation

- Colab
- Jupyter

More Business Use Cases

More General Tasks

- Clean Data
- Visualize Data
- Predict Labels
- Presence Detection
- Predict Numerical Values
- Detect Topics in Text
- Detect Sentiment
- Summarize Text
- Infer Absolute and Relative Risk
- Find Clusters
- Real-Time Decisions
- Automate Processes
- …

More Business Use Cases

Demand Prediction	Optimal Price Selection	Personalized Ads	Fraud Detection
Market Forecasting	Sentiment Analysis	Document Workflow Automation	Supplier Selection
Route Optimization	Credit Scoring	Algorithmic Trading	…

Generating Insights for AirBnB

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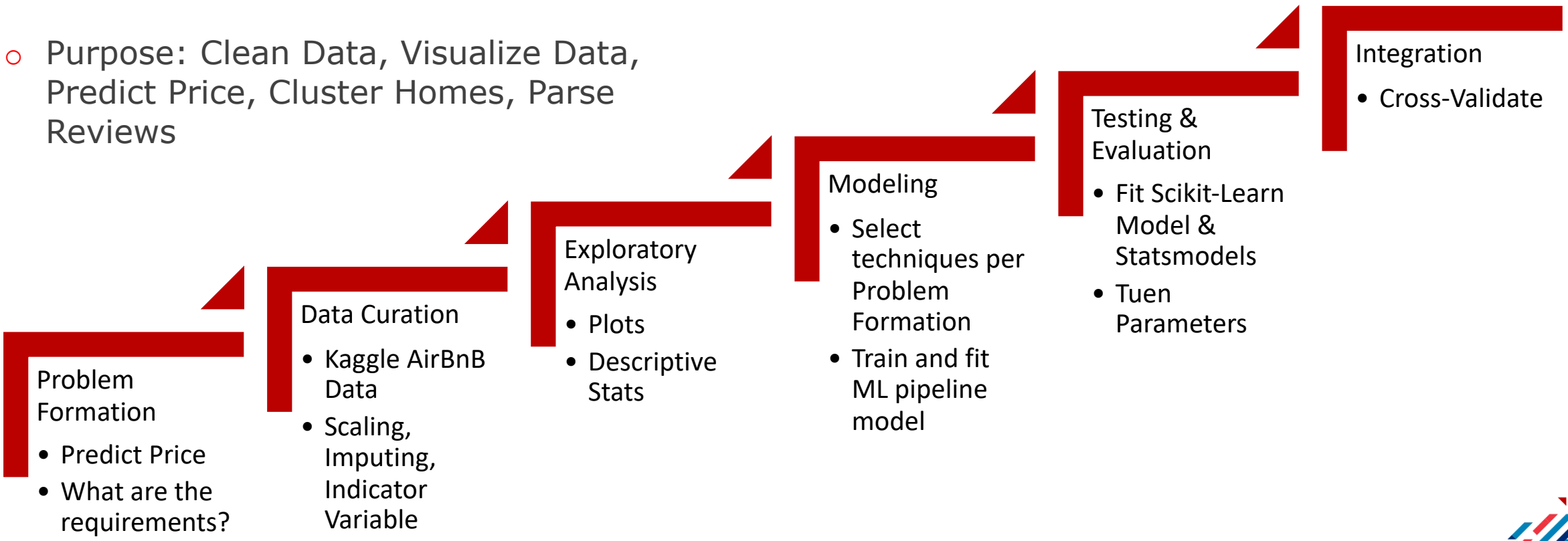
BLUF

- Purpose: Clean Data, Visualize Data, Predict Price, Cluster Homes, Parse Reviews



Let's Apply a Little Python + ML to the AirBnB Dataset with an *Interactive Tutorial*

Time to Code!

GitHub

Github Project Link:
https://github.com/carriegardner428/ML-with-Python-Tepper-CY21-AW4

colab

Colab Link:
https://colab.research.google.com/github/carriegardner428/ML-with-Python-Tepper-CY21-AW4/blob/main/

Parting Thoughts

- Thank you for your attention!
- Please reach out if you want to…
  - Learn more on these topics
  - Get more hands-on python and analytics experience (e.g., collaborative coding events)
  - Share your knowledge and experience on these topics
- Again: You can do this! 😀