# Berkeley Innovation Index

My Dinh
Jessica Gu
Aaron Lu
Dayou Wang
Yan Zeng
Yujun Zou

# Outline

- Problem Statement and Project Significance
- General Approach
- Model Selection
  - Assessment
  - Problems
- Final result
- User Interface Demo
- Limitations and Future Improvement
- Conclusion

# Problem Statement

Based on the Berkeley Innovation Index survey, create a hiring tool and generate an automated report

**BII: Individual Mindset**

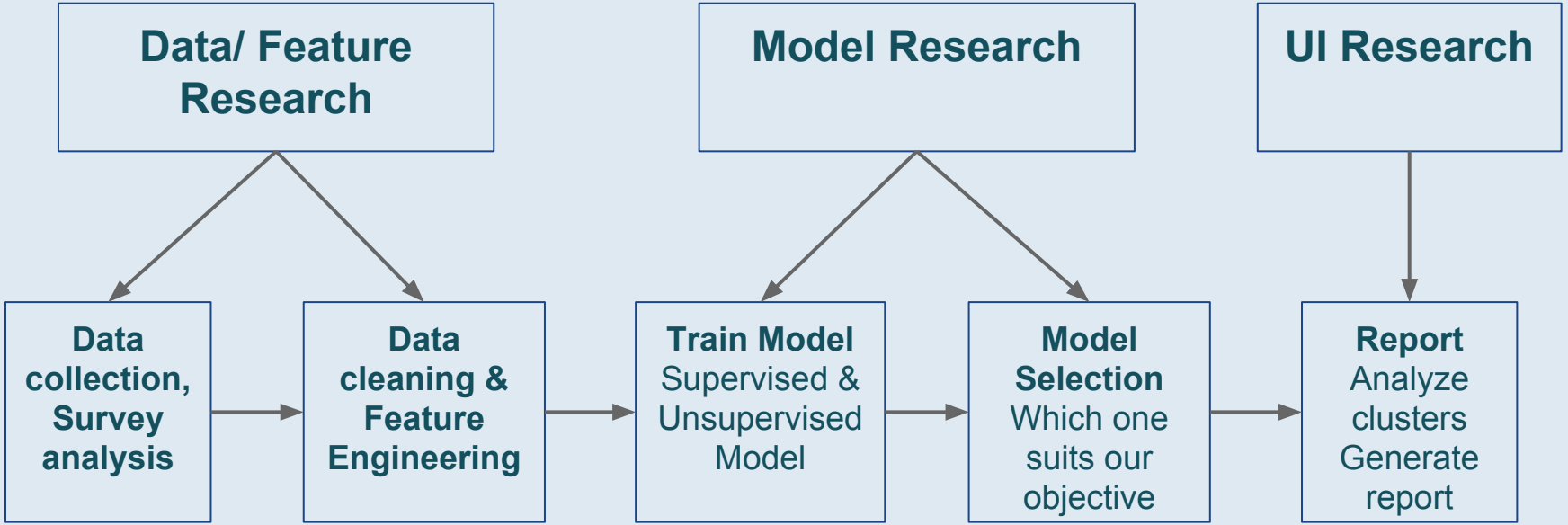

# Project Significance


Our potential users are **HRs** in the company, they can use this as a **hiring tool:**

1. Have a direct picture of the candidate's personality and behavior, to see if this person suits the position and company's culture

2. Based on the multiple reports created for each candidate, HR could have a clearer comparison between them and easier to pick the most ideal one

# General Approach

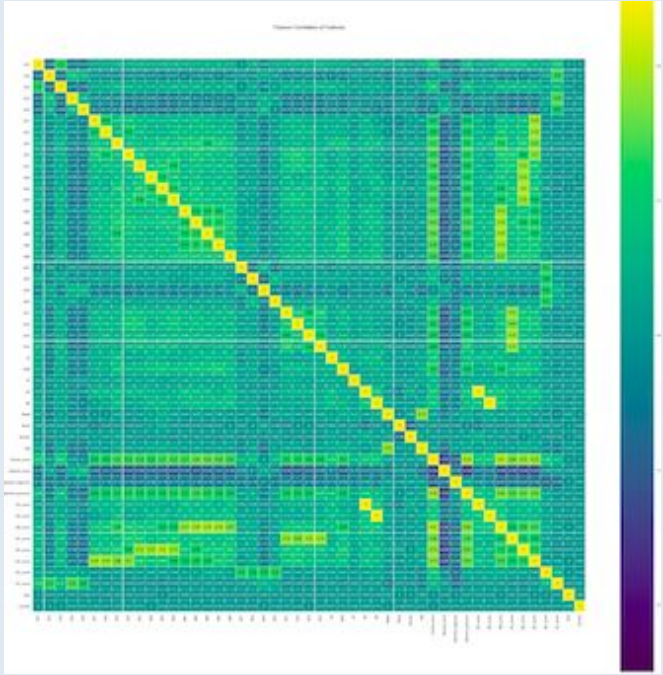


# Data Cleaning & Feature Engineering

- Data: Survey results in questions of trust, resilience, diversity, believe, effectiveness, collaboration, etc.

- Data Cleaning
  - Fake data cleaning
  - Non-numerical data cleaning

- Feature Engineering
  - Imbalanced Data - SMOTE
  - Correlation Verification
  - PCA & Recursive Feature Elimination(RFE)
  - Data normalization

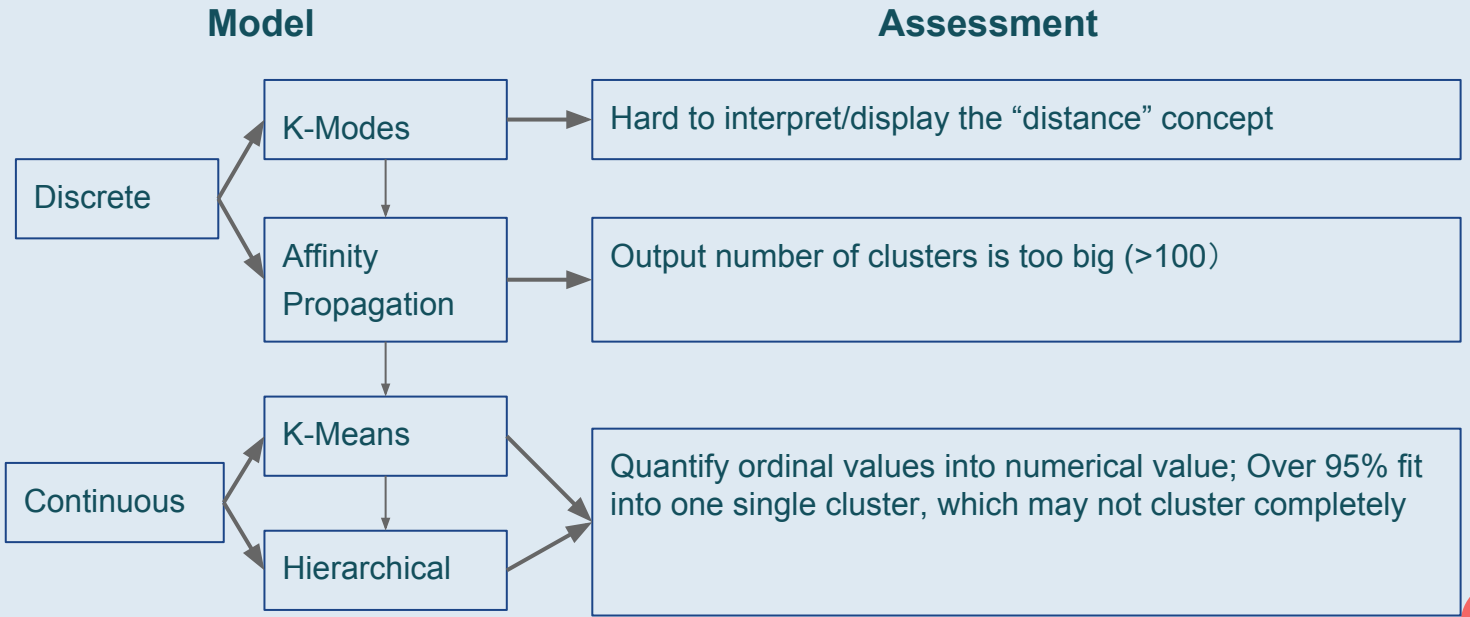


# Approach

- Supervised Models
  - Target: ER (been successful in innovation)
  - Level: 1, 2, 3, 4, 5
- Assessment:
  - 73% (40% for baseline model)
  - Innovation index = sum(i * P(belong to level i))

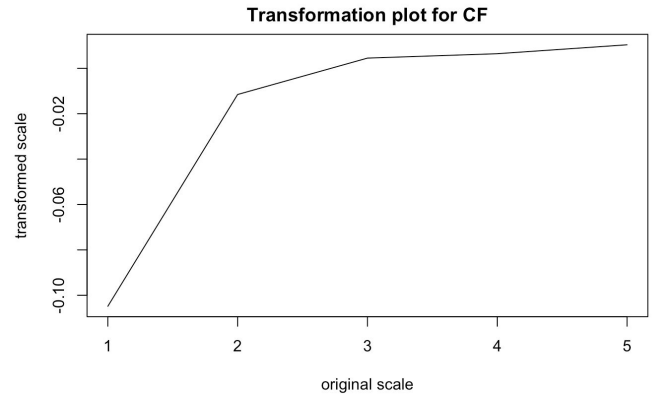
| | Type of Model | Training error | Testing error |
|---|---|---|---|
| 0 | Lofistic Regression | 46.37 | 42.00 |
| 1 | SVM | 49.63 | 44.67 |
| 2 | perceptron | 35.77 | 33.60 |
| 3 | KNN | 83.03 | 67.33 |
| 4 | XGBoost | 97.97 | 66.00 |
| 5 | Random Forest | 100.00 | 73.73 |

# Approach

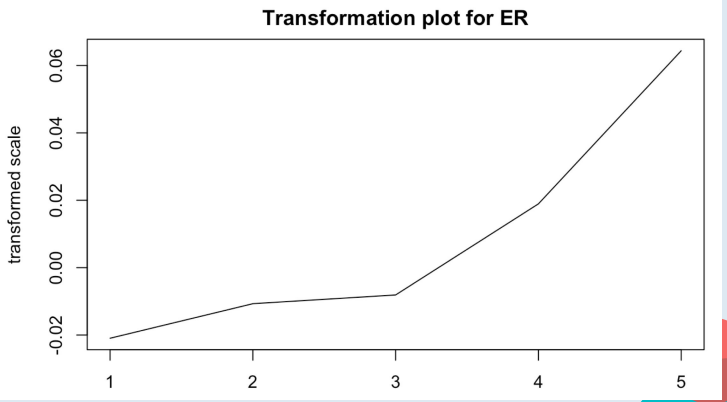

Model
Assessment
Discrete
K-Modes
Affinity Propagation
Continuous
K-Means
Hierarchical
Hard to interpret/display the “distance” concept
Output number of clusters is too big (>100）
Quantify ordinal values into numerical value; Over 95% fit into one single cluster, which may not cluster completely

# Approach - Hierarchical Clustering

1. Transform ordinal data into numerical data:




Use Alternative Least Square Algorithm to attain quantified ranking data

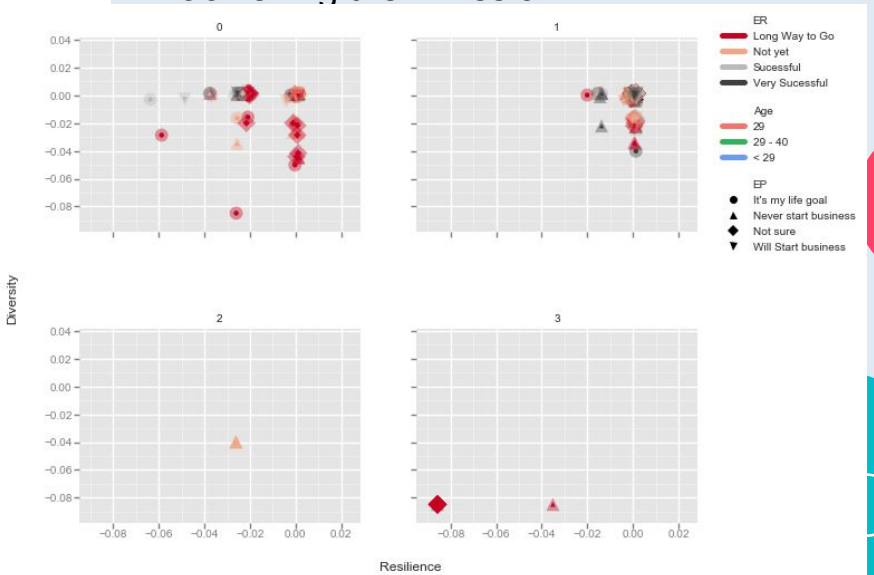


# 2. Fit hierarchical clustering:


## Group 2: Crusaders

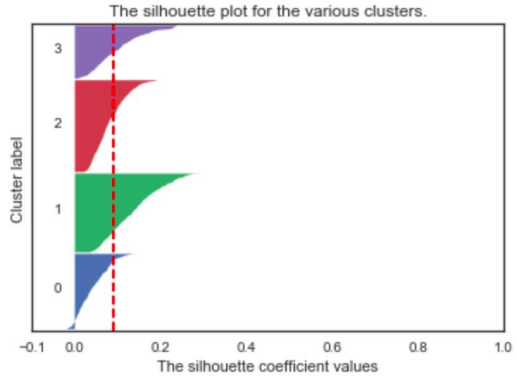
Very outgoing, high confidence and self-motivation. They are very quick and decisive when making new moves. Their energy level is always high and never give up until achieving their mission

They have a good balance of perfection and effectiveness. They are very persistent, detailed oriented, and methodological. They have a big picture and prefer information when making decision. Open for discussion to resolve the problems.



# Current Approach

```
For n_clusters = 4 The average silhouette score is: 0.0904859952522
For n_clusters = 5 The average silhouette score is: 0.0692447212389
For n_clusters = 6 The average silhouette score is: 0.0749957980912
For n_clusters = 7 The average silhouette score is: 0.0782534546677
For n_clusters = 8 The average silhouette score is: 0.0639206479419
```




Determine the ideal number of clusters (n=4)

↓

K-Means Clustering algorithm

↓

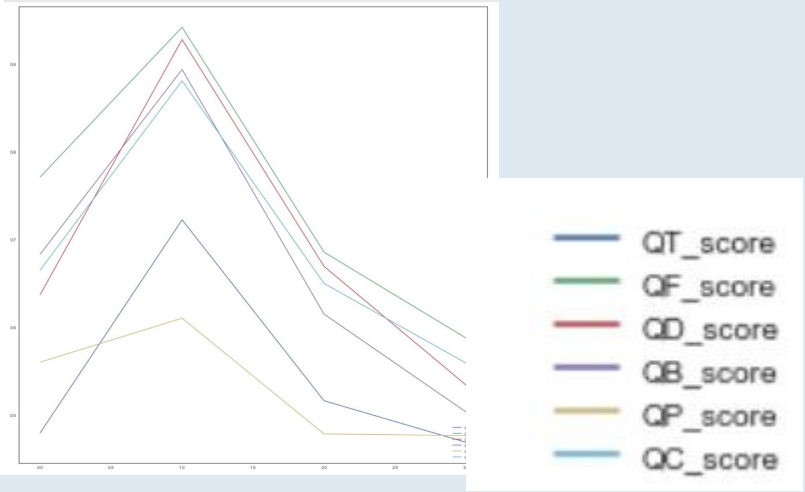
Analyze and interpret each cluster

↓

Create deliverable for HR

# Current Approach

Group means are plotted to give a better visualization.




| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| CZ | 0.52 | 0.76 | 0.49 | 0.39 |
| SDR | 0.67 | 0.87 | 0.70 | 0.52 |
| CF | 0.53 | 0.58 | 0.57 | 0.47 |
| EP | 0.71 | 0.88 | 0.61 | 0.43 |
| ER | 0.39 | 0.56 | 0.37 | 0.29 |
| Stage | 0.00 | 0.01 | 1.00 | 0.02 |
| Study | 0.08 | 0.46 | 0.39 | 0.49 |
| Age | 0.01 | 0.02 | 0.49 | 0.01 |
| QT_score | 0.48 | 0.72 | 0.52 | 0.47 |
| QF_score | 0.77 | 0.94 | 0.69 | 0.59 |
| QD_score | 0.64 | 0.93 | 0.67 | 0.53 |
| QB_score | 0.68 | 0.89 | 0.62 | 0.50 |
| QP_score | 0.56 | 0.61 | 0.48 | 0.48 |
| QC_score | 0.67 | 0.88 | 0.65 | 0.56 |
| overall_score | 0.56 | 0.80 | 0.53 | 0.42 |
| extreme_score | 0.16 | 0.56 | 0.15 | 0.11 |
| neutral_score | 0.27 | 0.08 | 0.28 | 0.41 |

# Final Results: 4 clusters

**Administrator**

- Performs well especially in routine works and might need more incentives for potential challenges.

**Captain**

- Team leaders, always optimistic and self-determinate about challenges, and good at communicating with teammates.

**Critic**

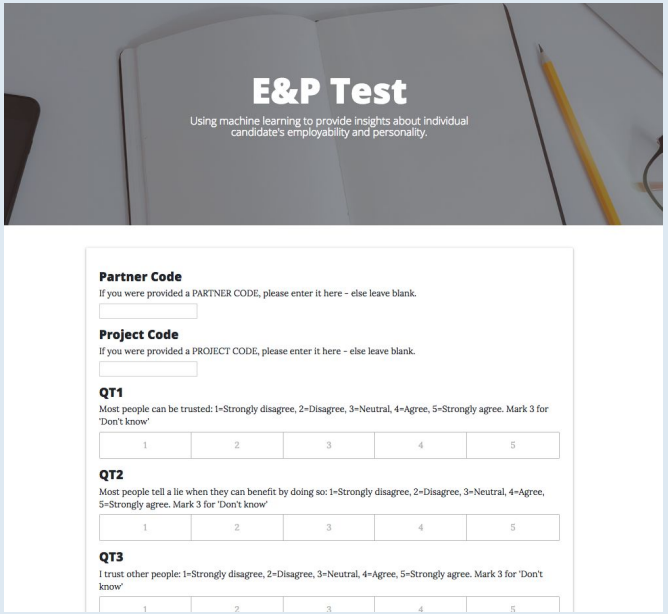
- Curious people that self-motivated for challenges and attempts for every possible outcome.

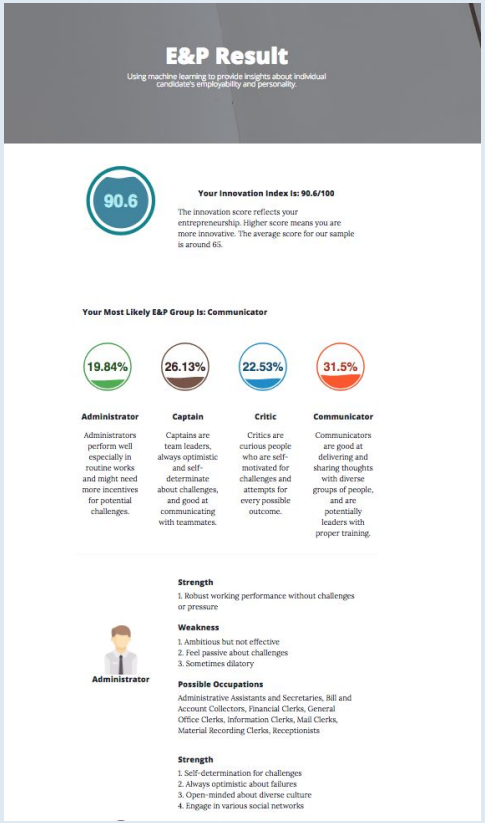
**Communicator**

- Good at delivering and sharing thoughts with diverse groups of people, and are potentially leaders with proper training.

# User Interface Demo

https://bii.herokuapp.com/bii/



# Limitations & Future Improvement

- Revise questions in the survey
  - Add validation questions, to determine whether the data is ‘useful’
  - Add critical questions, that have more **weights** towards the final clusters
- Further research on unsupervised continuous clustering models
- Change the current static model to dynamic model, and update the parameters of the clusters frequently

# Conclusion

- Understand the data
  - Group the questions in survey
  - Data Cleaning and Feature Engineering
    - Dimension reduction
    - Normalization
- Training the data
  - Supervised ML models
  - Unsupervised ML models
    - Discrete vs. continuous data
- Interpret the results and revise the model
- Future improvements

# Thank You!

**GitHub:**

https://github.com/aaronLinLu/BII_290GroupProject