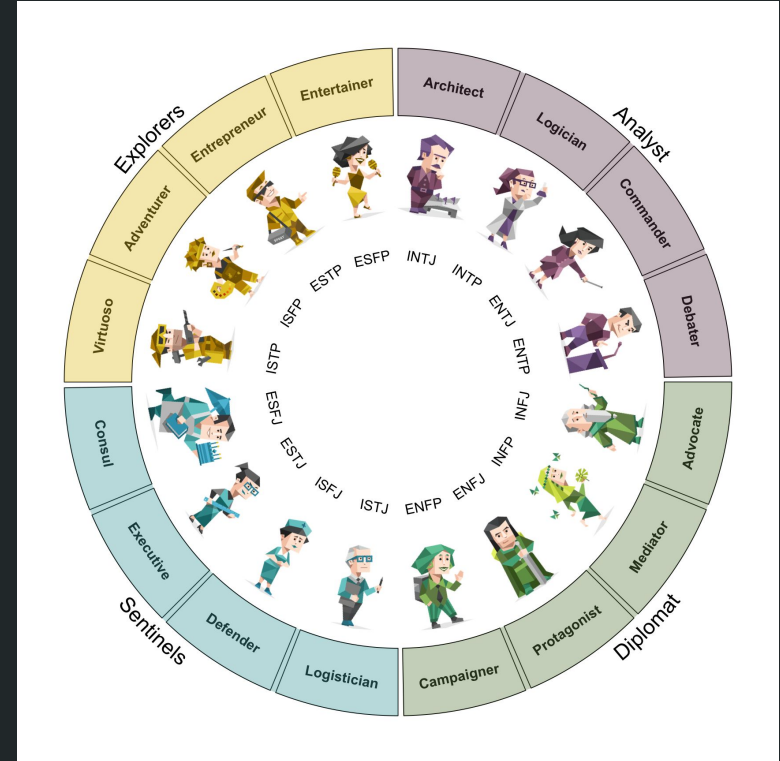


Predicting MBTI using Multi-layer Perceptrons

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Springboard Data Science

Introduction

- 4 dimensions of personality expressed in 1 label
- MBTI relies on self-reporting
- NLP classification
- Using data from [personalitycafe.com](https://www.personalitycafe.com)
 - Type - user reported
 - Text - collection of posts for that user
- Consumer analytics, workforce management

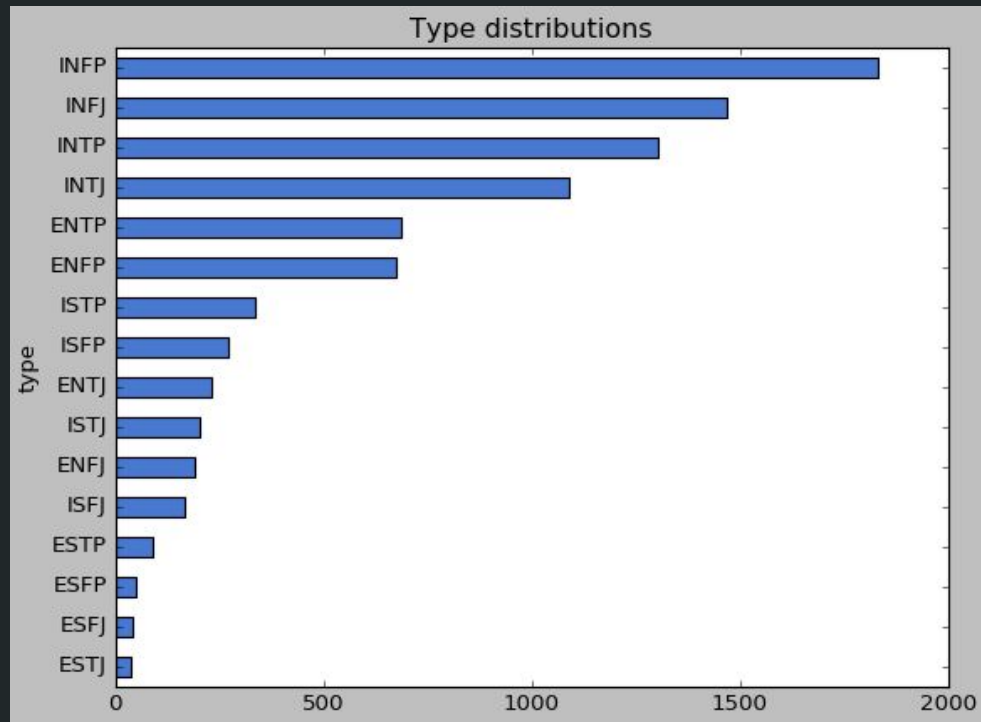


Applications

- Team placement
 - Communication styles
 - Strengths and weaknesses
- Consumer analytics
 - Reviews, comments, etc.
 - Targeted marketing
 - Product development
- Data is contextual

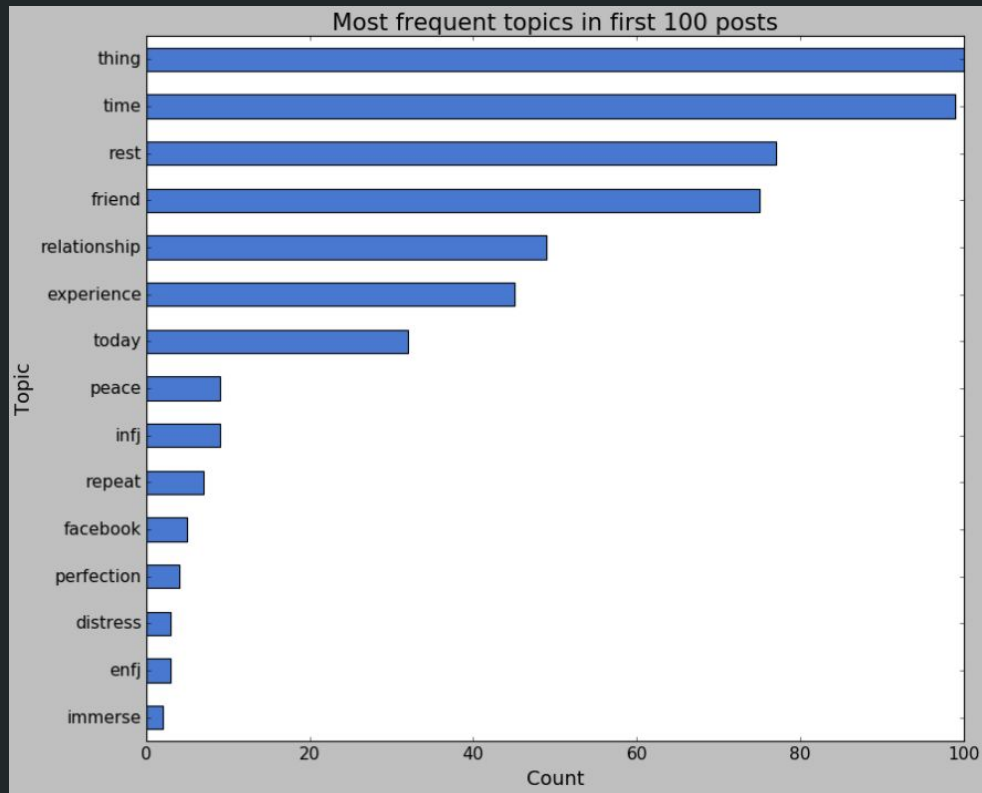
Data

- Problem 1: Class imbalance
 - Not representative of population
 - Coefficient-based normalization
- Problem 2: Non-meaningful text
 - Direct mentions of MBTI codes
- Feature engineering
 - Emotion vectors
 - Polarity, subjectivity (using TextBlob sentiment)



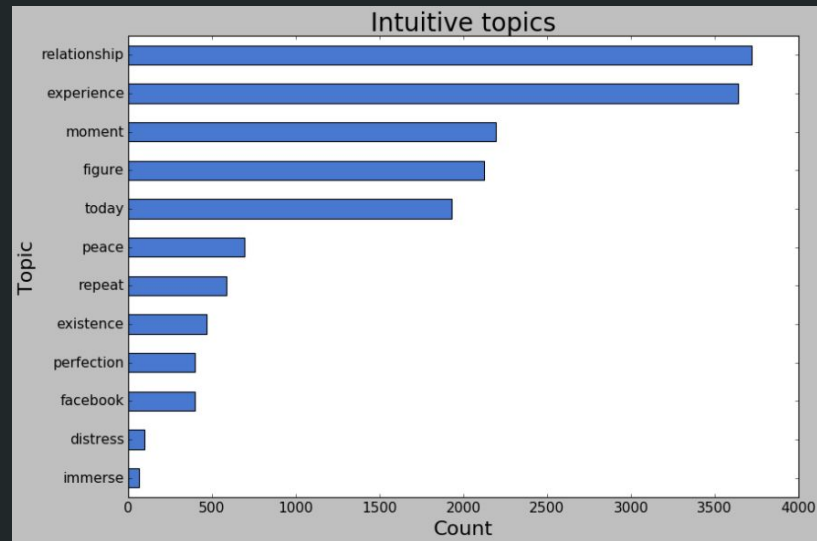
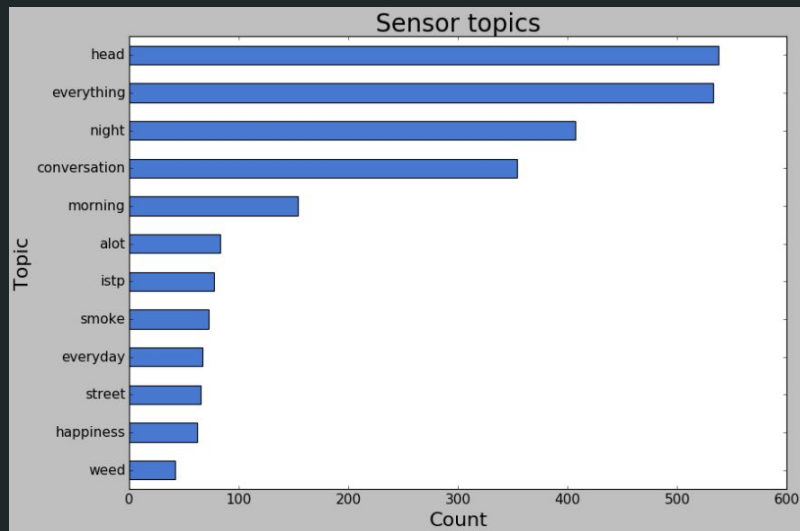
Topic modeling

- First 100 samples
- General trends in the forum
- “time”, “relationship”, “experience”
- Discussions tended toward the abstract



Topic modeling

- Comparing topics for binary dimensions
- Intuitives vs. sensors

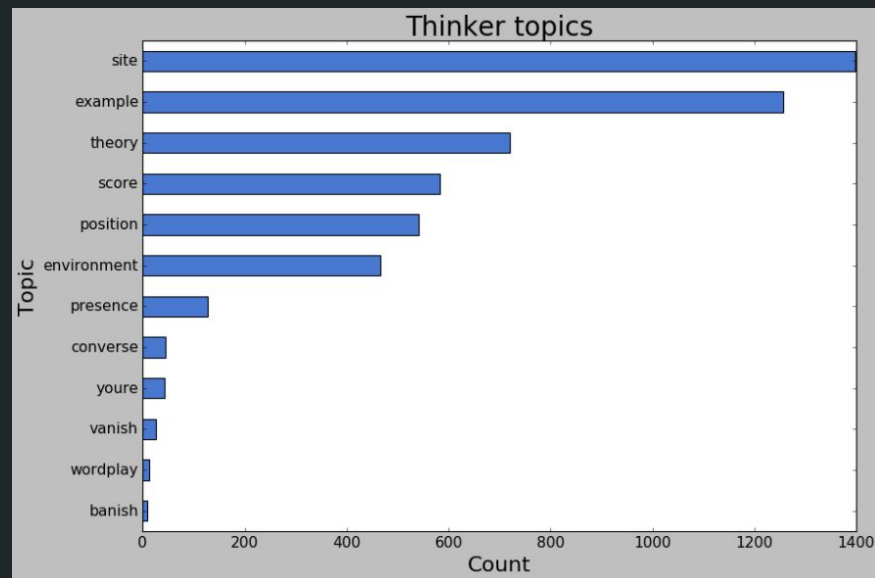
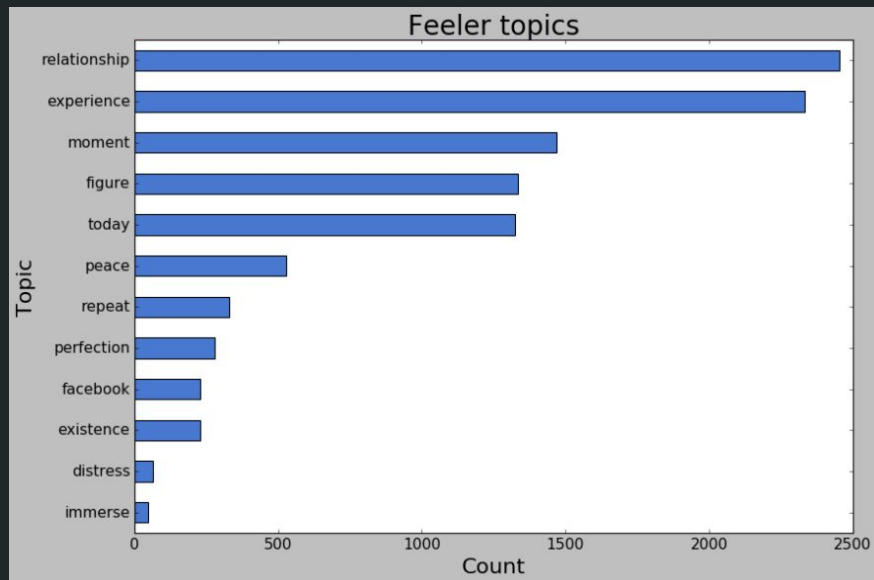


I: relationship, peace, existence, perfection

S: conversation, night/morning, smoke, weed

Topic modeling

- Thinkers vs. feelers

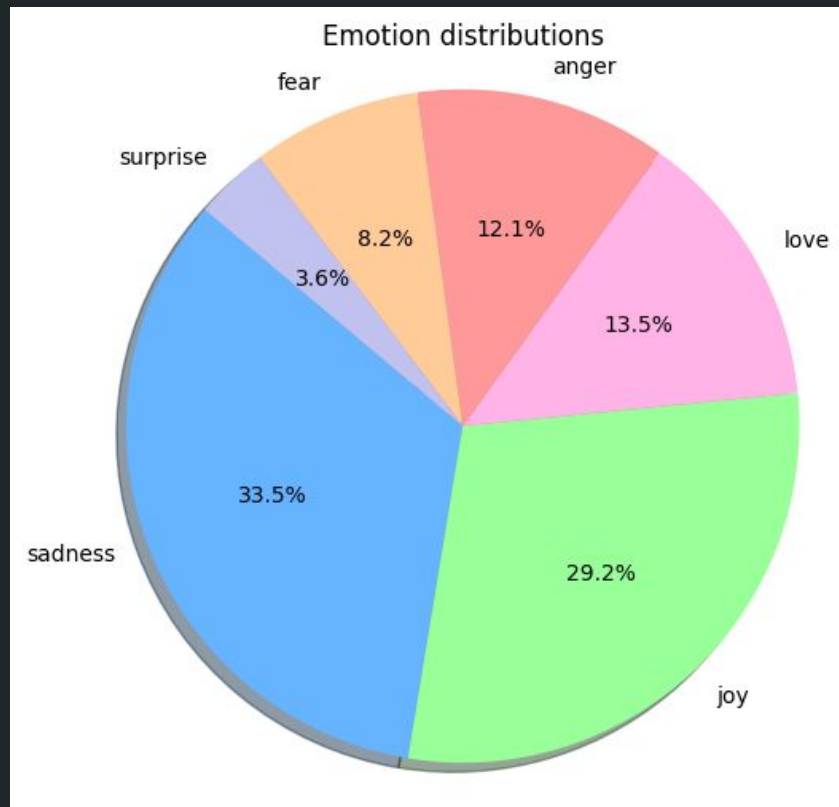


T: example, theory, score, position

F: relationship, experience, peace

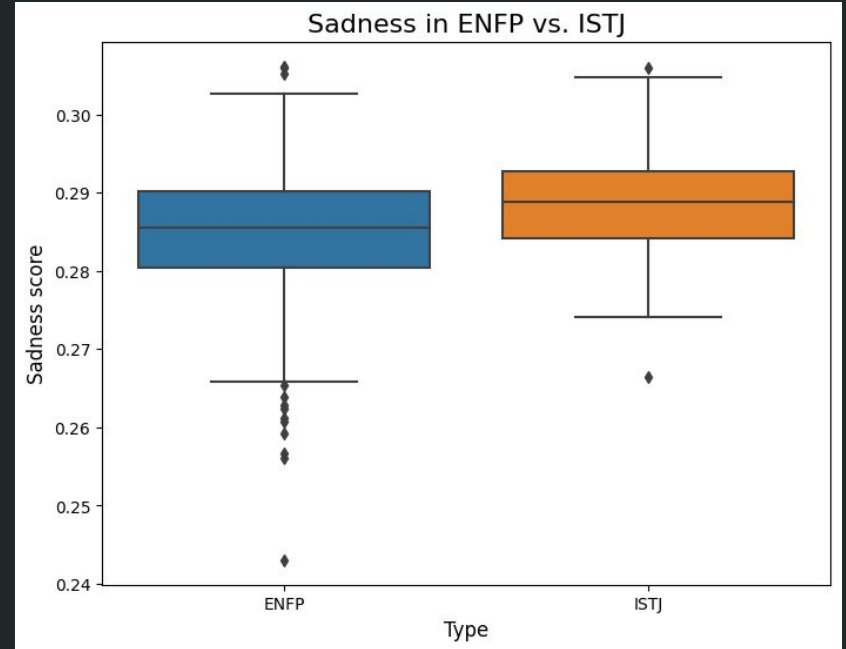
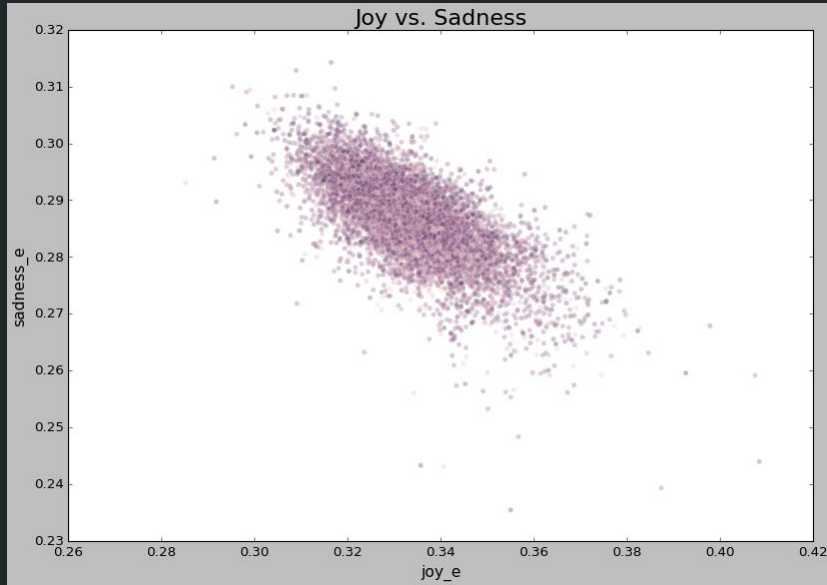
Emotions analysis

- Text labeled by emotion
 - Anger, fear, joy, love, sadness, surprise
- Similar context to MBTI data
- Joy and sadness represented ~60% of samples
- Logistic regression
 - Accuracy: 36.5%
 - Baseline (random): 16.7%



Emotions analysis

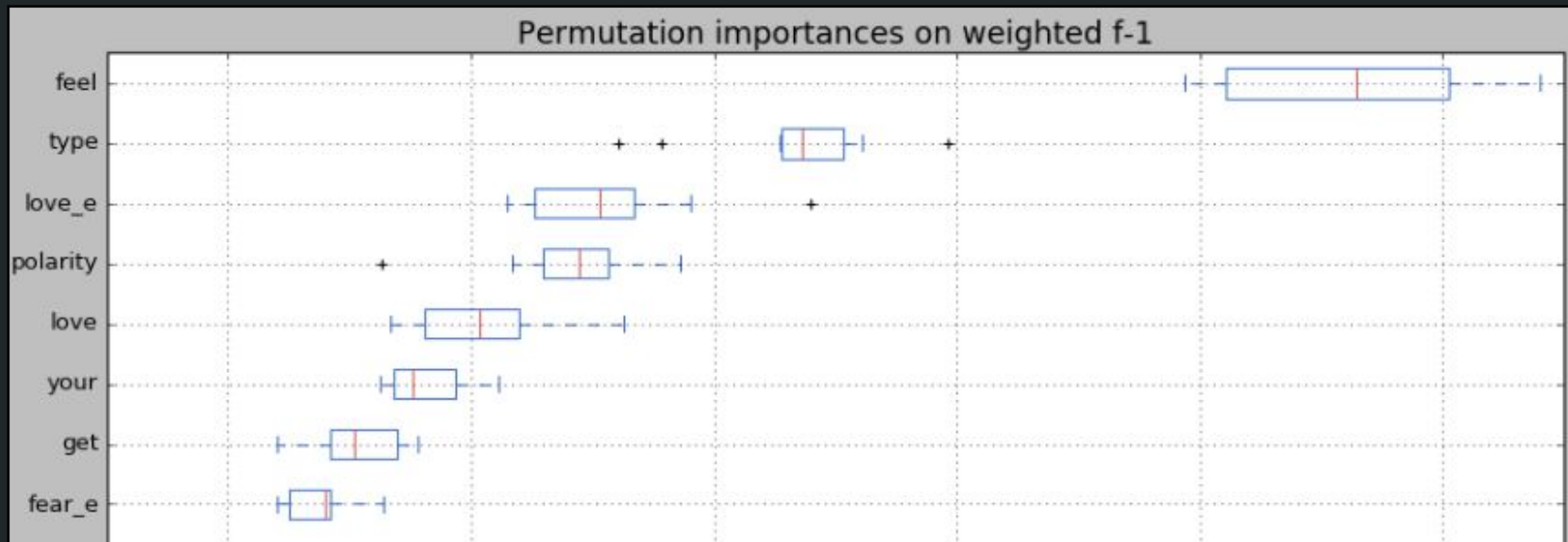
- Applied to MBTI data
- Semantics of joy vs. sadness



- ENFP/ISTJ sadness scores

Feature importance

- Random Forest permutation importance
- Newly engineered emotion features proved effective



Model selection

Classifier	Untuned	Tuned for accuracy	Tuned for balanced accuracy
Random Forest	53.6	53.57	53.57
K-Nearest Neighbors	33.5	--	--
Naive Bayes	20.6	--	--
MLP (Multi-layer Perceptron)	52.3	57.10	<u>57.97</u>

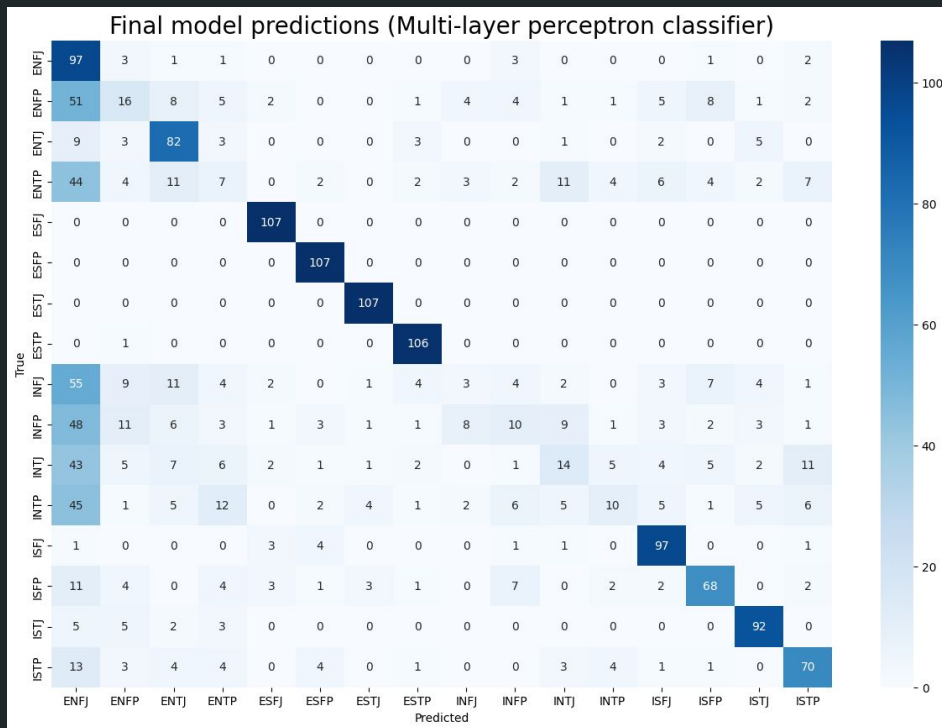
Final model

- Multi-layer perceptron classifier with 2 hidden layers
- Balanced accuracy on test set: **57.7 %**
- Performance by class:

	ENFJ	ENFP	ENTJ	ENTP	ESFJ	ESFP	ESTJ	ESTP	INFJ	INFP	INTJ	INTP	ISFJ	ISFP	ISTJ	ISTP
precision	0.64	0.26	0.59	0.15	0.88	0.84	0.86	0.83	0.16	0.36	0.24	0.39	0.71	0.61	0.73	0.58
recall	0.81	0.17	0.78	0.09	1.00	1.00	1.00	0.99	0.04	0.20	0.16	0.15	0.91	0.63	0.91	0.69
f1-score	0.72	0.21	0.67	0.11	0.93	0.91	0.92	0.91	0.06	0.26	0.19	0.22	0.80	0.62	0.81	0.63
support	108.00	109.00	108.00	109.00	107.00	107.00	107.00	107.00	110.00	111.00	109.00	110.00	108.00	108.00	107.00	108.00

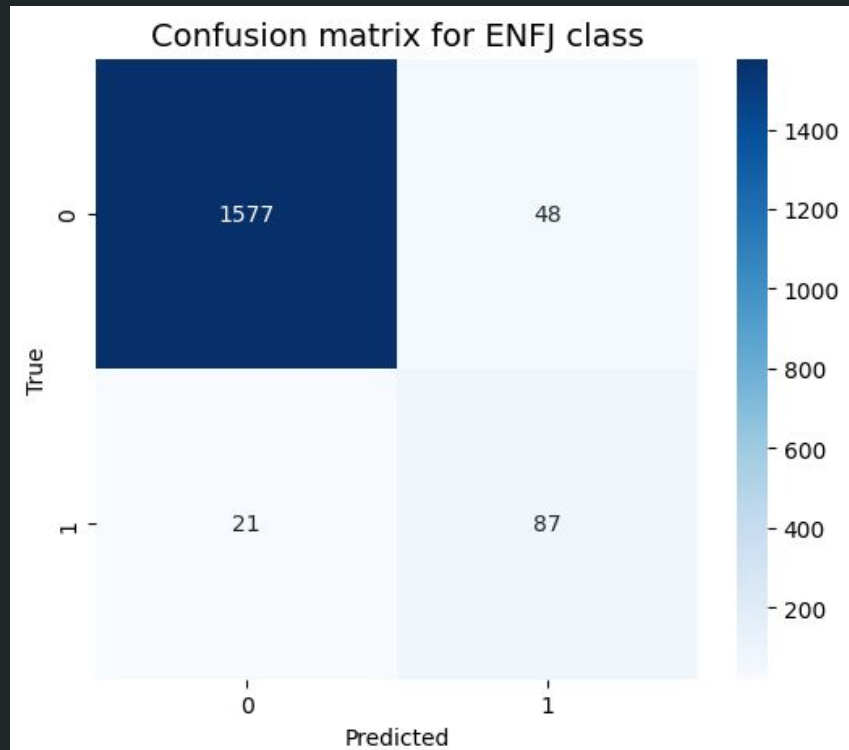
Final model

- Good with minority classes
- Worse with majority classes (initially overrepresented, INFJ and INFP especially)
- Tradeoff
- Earlier models using original class sizes were extremely biased toward majority classes



Final model

- Most noticeably biased toward predicting ENFJ
- Just showed that the overall predictive ability of the model was strong enough to make this stand out and seem like a bigger problem



Reflections

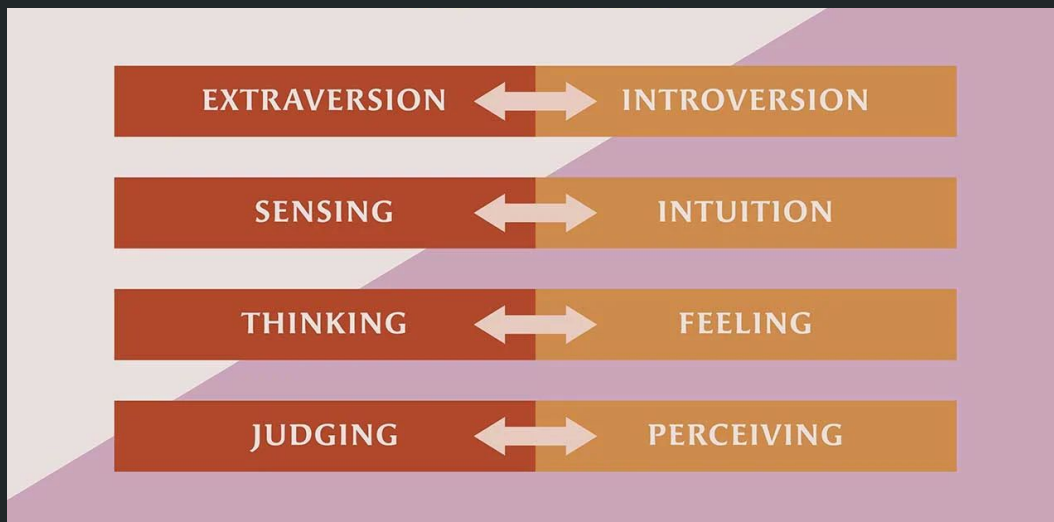
- Required tradeoff
 - Underpredicting minority classes
 - Underpredicting majority classes
- Compared to online MBTI quizzes (indicators, questions)
 - ~50% of users will receive a different result on retest
 - Compared to 58% on MLP classification model
- Core problem: Self-reporting

Reflections

- Much stronger performance than expected: 57.7%
- Baseline (random) = 6.25%
- Applied to employee social media data, work chats/message boards
 - Cohesive teams, complementary strengths
- Applied to customer reviews, forums
 - ex. telehealth company providing mental health services
 - Introverts vs. extraverts

Alternative approaches

- Combination of four binary classifiers
- Cognitive function theory



INTP = Ti > Ne > Si > Fe

ISTP = Ti > Se > Ni > Fe

ENTP = Ne > Ti > Fe > Si

ENFP = Ne > Fi > Te > Si

ISFP = Fi > Se > Ni > Te

INFP = Fi > Ne > Si > Te

INTJ = Ni > Te > Fi > Se

INFJ = Ni > Fe > Ti > Se

ESTJ = Te > Si > Ne > Fi

ENTJ = Te > Ni > Se > Fi

ESFJ = Fe > Si > Ne > Ti

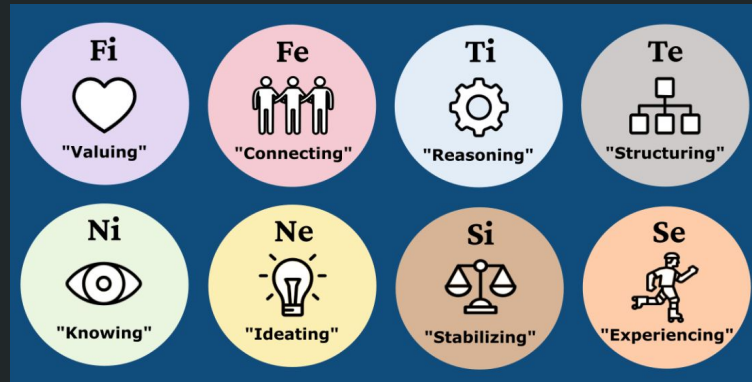
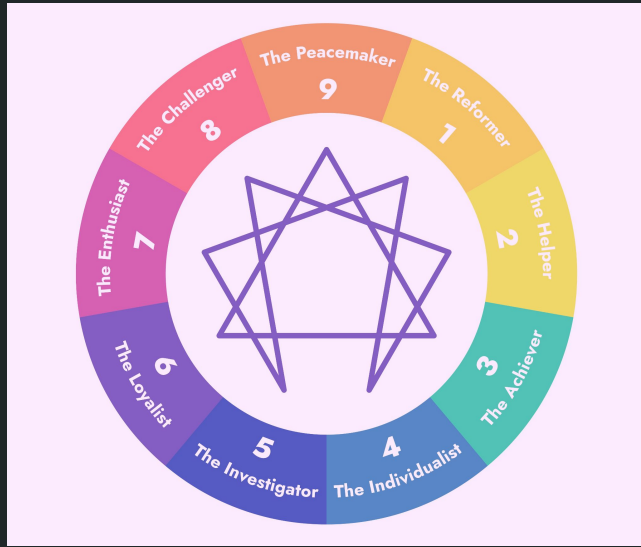
ENFJ = Fe > Ni > Se > Ti

ISTJ = Si > Te > Fi > Ne

ISFJ = Si > Fe > Ti > Ne

ESTP = Se > Ti > Fe > Ni

ESFP = Se > Fi > Te > Ni

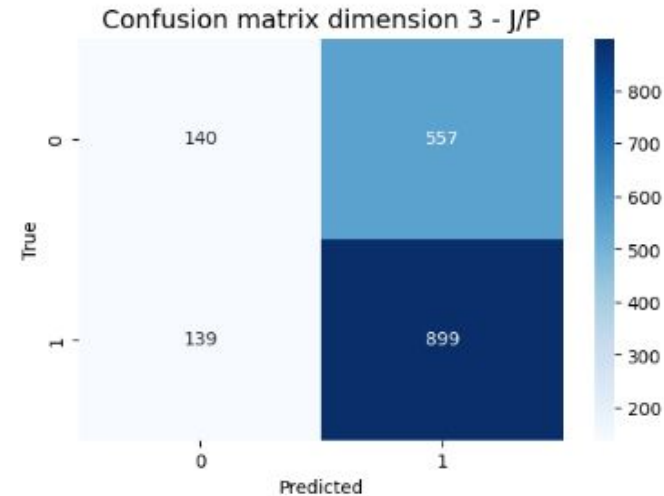
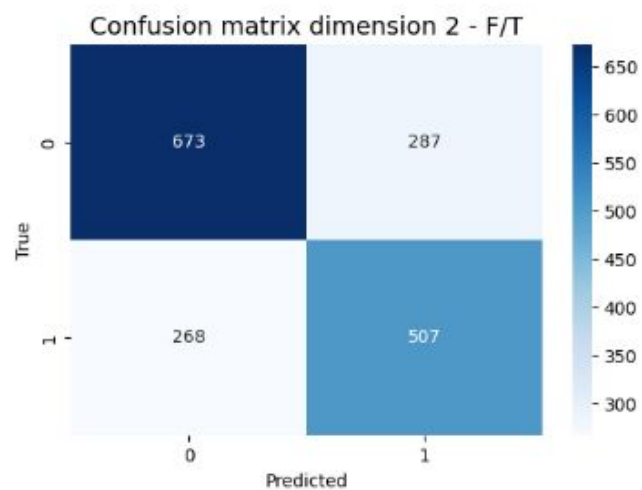
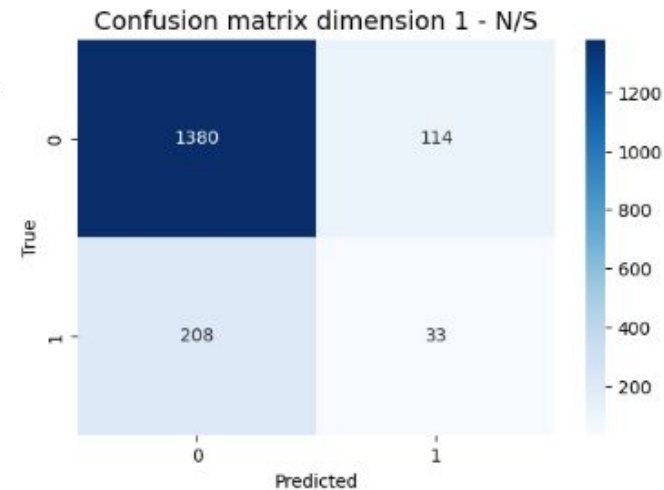
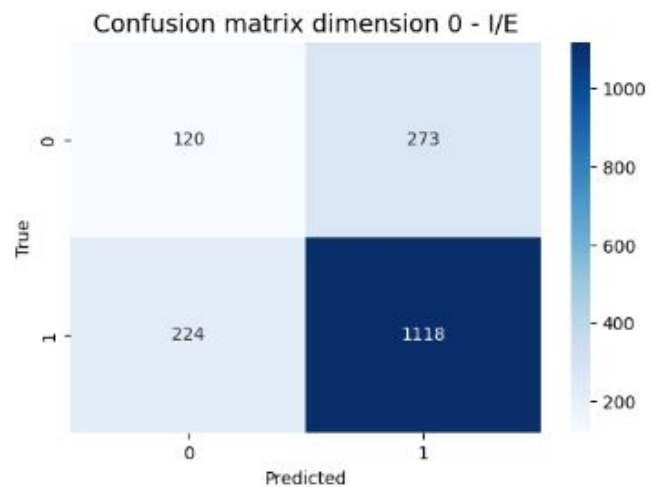


... & more!

Addendum

- Tested alternative: 4-dimension classification system
- Single response vs. partial correctness

Dimension 0	I, or introverted	E, or extraverted
Dimension 1	N, or intuitive	S, or sensing
Dimension 2	F, or feeling	T, or thinking
Dimension 3	J, or judging	P, or prospecting



Reflections

- Average balanced accuracy of 4 models: 58%
- Marginal improvement IF allowing for partial correctness
- Overall balanced accuracy (single-response): 26.8%
- Not applicable in original business scenario
- Personal use

References

MacCarthy, Libby. “Why Your Myers-Briggs Personality Type Is Meaningless.” Edited by Stacia Alexander, Psycom, HealthCentral LLC, 23 Feb. 2023, www.psycom.net/myers-briggs-personality-type.