INTRODUCTION TO NATURAL LANGUAGE PROCESSING IN PYTHON

Classifying fake news using supervised learning with NLP

Katharine Jarmul
Founder, kjamistan

What is supervised learning?

- Form of machine learning
  - Problem has predefined training data
  - This data has a label (or outcome) you want the model to learn
  - Classification problem
  - Goal: Make good hypotheses about the species based on geometric features

Sepal Length	Sepal Width	Petal Length	Petal Width	Species
5.1	3.5	1.4	0.2	I. setosa
7.0	3.2	4.77	1.4	I.versicolor
6.3	3.3	6.0	2.5	I.virginica

Supervised learning with NLP

- Need to use language instead of geometric features
- `scikit-learn`: Powerful open-source library
- How to create supervised learning data from text?
  - Use bag-of-words models or tf-idf as features

IMDB Movie Dataset

Plot	Sci-Fi	Action
In a post-apocalyptic world in human decay, a ...	1	0
Mohei is a wandering swordsman. He arrives in ...	0	1
#137 is a SCI/FI thriller about a girl, Marla,...	1	0

- Goal: Predict movie genre based on plot summary
- Categorical features generated using preprocessing

Supervised learning steps

- Collect and preprocess our data
- Determine a label (Example: Movie genre)
- Split data into training and test sets
- Extract features from the text to help predict the label
  - Bag-of-words vector built into `scikit-learn`
- Evaluate trained model using the test set

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Let's practice!

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Building word count vectors with scikit-learn

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Founder, kjamistan

Predicting movie genre

- Dataset consisting of movie plots and corresponding genre
- Goal: Create bag-of-word vectors for the movie plots
  - Can we predict genre based on the words used in the plot summary?

Count Vectorizer with Python

```
In [1]: import pandas as pd

In [2]: from sklearn.model_selection import train_test_split

In [3}: from sklearn.feature_extraction.text import CountVectorizer

In [4]: df = ... # Load data into DataFrame

In [5]: y = df['Sci-Fi']

In [6]: X_train, X_test, y_train, y_test = train_test_split(
                                              df['plot'], y,
                                              test_size=0.33,
                                              random_state=53)

In [7]: count_vectorizer = CountVectorizer(stop_words='english')

In [8]: count_train = count_vectorizer.fit_transform(X_train.values)

In [9]: count_test = count_vectorizer.transform(X_test.values)
```

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Training and testing a classification model with scikit-learn

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Naive Bayes classifier

- Naive Bayes Model
  - Commonly used for testing NLP classification problems
  - Basis in probability
- Given a particular piece of data, how likely is a particular outcome?
- Examples:
  - If the plot has a spaceship, how likely is it to be sci-fi?
  - Given a spaceship **and** an alien, how likely **now** is it sci-fi?
- Each word from `CountVectorizer` acts as a feature
- Naive Bayes: Simple and effective

Naive Bayes with scikit-learn

```
In  [10]: from sklearn.naive_bayes import MultinomialNB

In  [11]: from sklearn import metrics

In  [12]: nb_classifier = MultinomialNB()

In  [13]: nb_classifier.fit(count_train, y_train)

In  [14]: pred = nb_classifier.predict(count_test)

In  [15]: metrics.accuracy_score(y_test, pred)
Out [15]: 0.8584184938982042 4
```

Confusion Matrix

```
In  [16]: metrics.confusion_matrix(y_test, pred, labels=[0,1])
Out [16]:
array([[6410,  563],
       [ 864, 2242]])
```

	Action	Sci-Fi
Action	6410	563
Sci-Fi	864	2242

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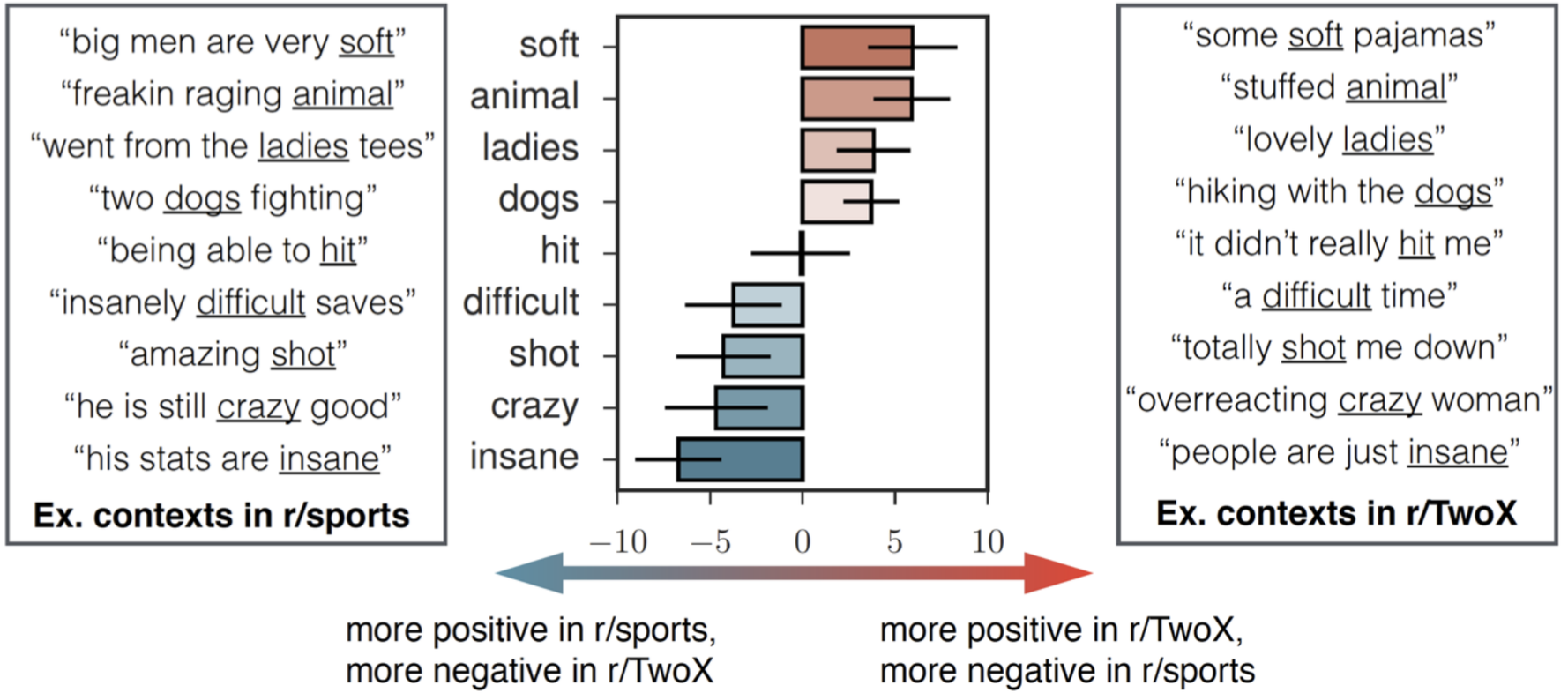
Simple NLP, Complex Problems

Katharine Jarmul
Founder, kjamistan

Translation

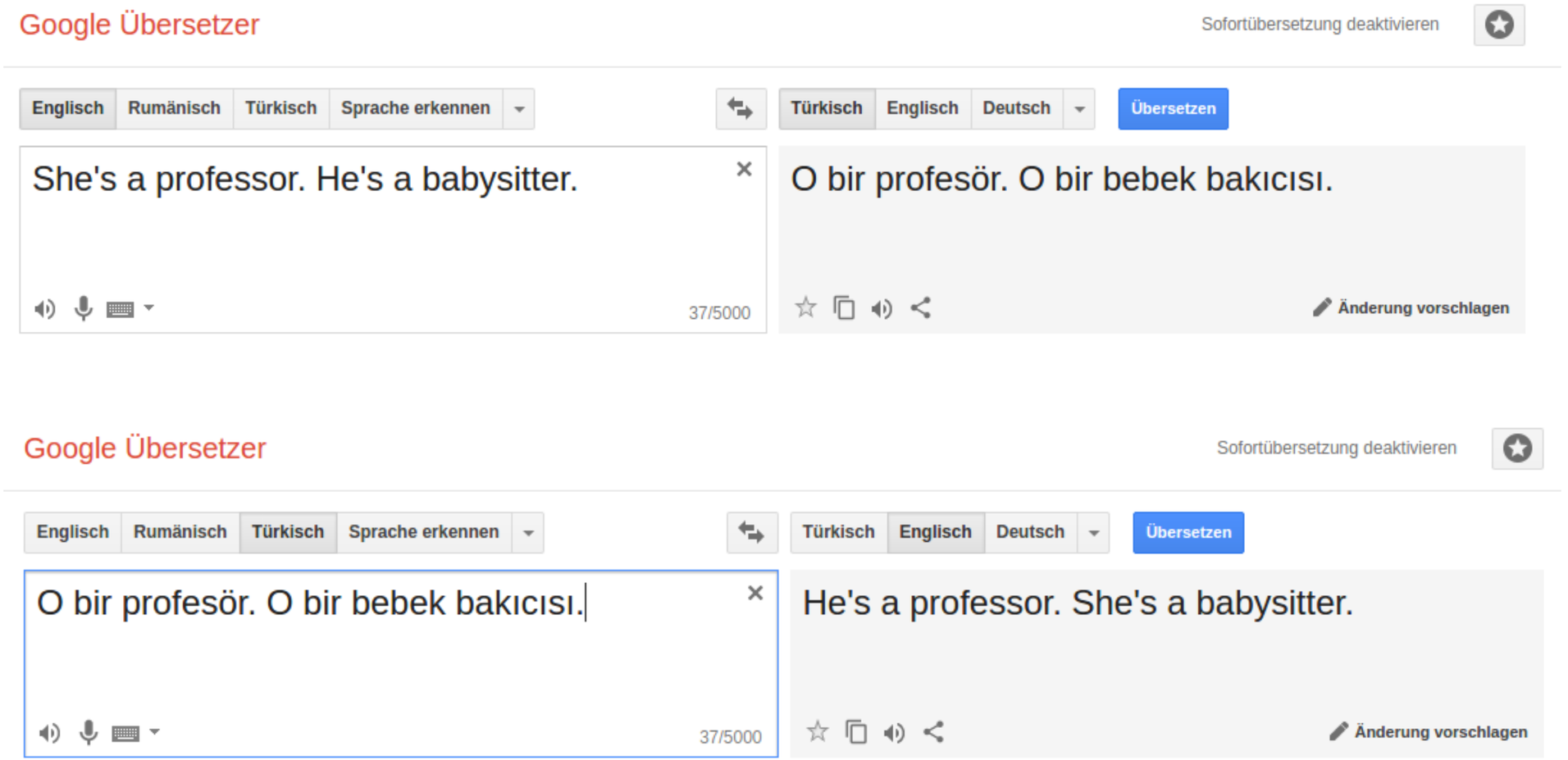
(source: https://twitter.com/Lupintweets/status/865533182455685121)

Sentiment Analysis



(source: https://nlp.stanford.edu/projects/socialsent/)

Language Biases



(related talk: https://www.youtube.com/watch?v=j7FwpZB1hWc)

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