

# DataLab Cup 1: Predicting News Popularity

DataLab

# Outline

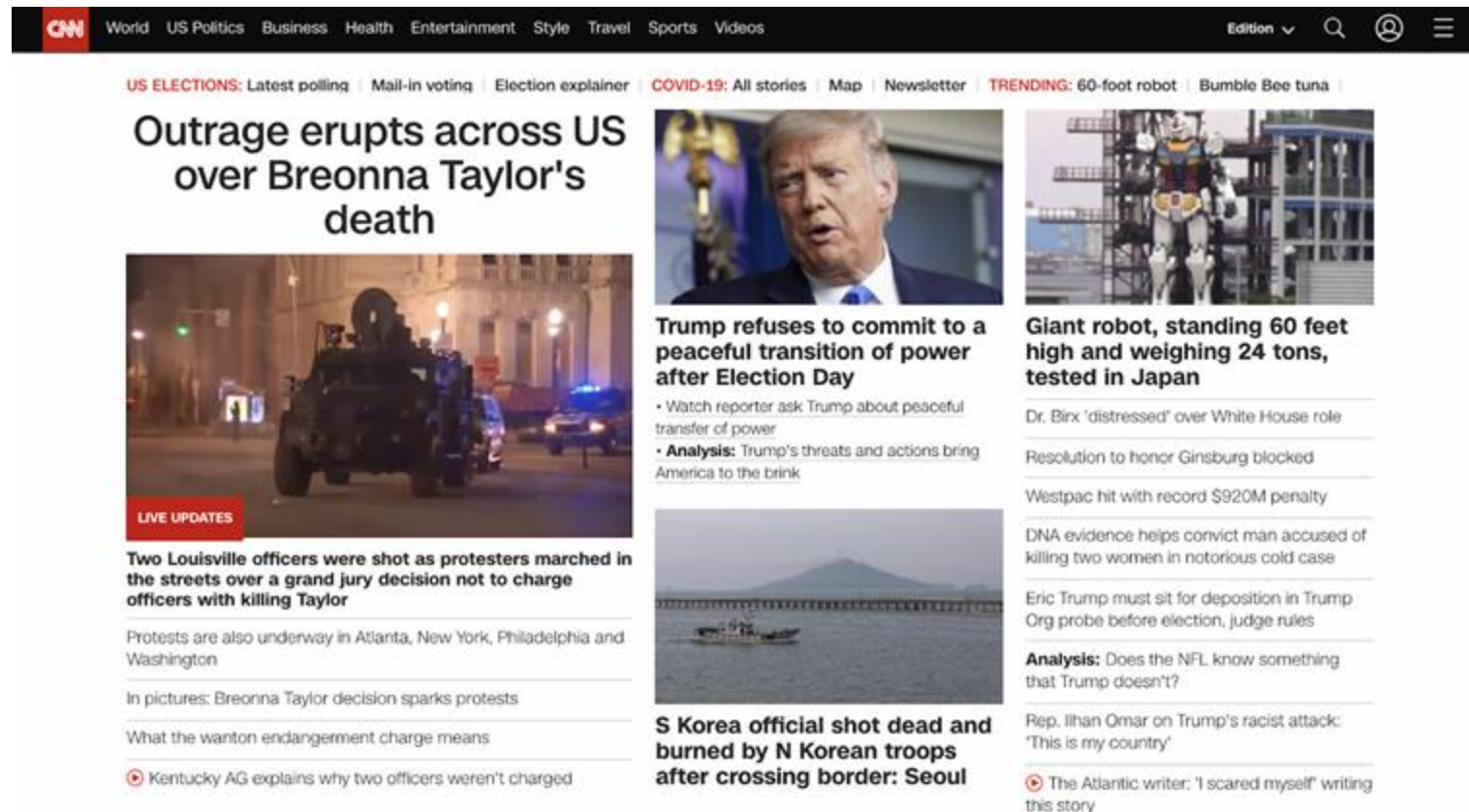
- Competition information
- Method
- Evaluation metric
- Report & Show off
- Precautions

# Outline

- Competition information
- Method
- Evaluation metric
- Report & Show off
- Precautions

# Competition Information - Goal

- Predict the news popularity



The screenshot shows the CNN website homepage. The top navigation bar includes the CNN logo and links to World, US Politics, Business, Health, Entertainment, Style, Travel, Sports, and Videos. A search bar and user account icon are on the right. Below the navigation bar, there are several news stories:

- US ELECTIONS:** Latest polling | Mail-in voting | Election explainer
- COVID-19:** All stories | Map | Newsletter
- TRENDING:** 60-foot robot | Bumble Bee tuna

The main headline is "Outrage erupts across US over Breonna Taylor's death" with a "LIVE UPDATES" tag. Below it is a photo of a police vehicle at night. The sub-headline reads: "Two Louisville officers were shot as protesters marched in the streets over a grand jury decision not to charge officers with killing Taylor". Below this, it says: "Protests are also underway in Atlanta, New York, Philadelphia and Washington" and "In pictures: Breonna Taylor decision sparks protests".

Other headlines include:

- Trump refuses to commit to a peaceful transition of power after Election Day**  
• Watch reporter ask Trump about peaceful transfer of power  
• **Analysis:** Trump's threats and actions bring America to the brink
- Giant robot, standing 60 feet high and weighing 24 tons, tested in Japan**  
Dr. Birx 'distressed' over White House role  
Resolution to honor Ginsburg blocked  
Westpac hit with record \$920M penalty  
DNA evidence helps convict man accused of killing two women in notorious cold case  
Eric Trump must sit for deposition in Trump Org probe before election, judge rules  
**Analysis:** Does the NFL know something that Trump doesn't?
- S Korea official shot dead and burned by N Korean troops after crossing border: Seoul**  
Rep. Ilhan Omar on Trump's racist attack: 'This is my country'
- Kentucky AG explains why two officers weren't charged**

# Competition Information - Dataset

- Training data
  - 27643 pieces of news
- Testing data
  - 11847 pieces of news

## Ouya gaming console sells out on Amazon

By Todd Wasserman, Mashable  
Updated 5:13 GMT (2013 HKT) June 25, 2013



The Ouya sells for \$99 and all games will at least offer a free trial period or free-to-play version.

### STORY HIGHLIGHTS

- Ouya gaming console sells out in hours on Amazon
- Android-based console sells for \$99

Well, that was quick. Just hours after going on sale in the U.S., Canada and the UK, the Ouya gaming console was already sold out Tuesday morning on Amazon, though other retailers still had it in stock.

Amazon, which was selling the device for \$99, told customers that the item was temporarily out of stock.

However, as of Tuesday morning, Target and Best Buy were still carrying Ouya. GameStop noted that the item was "currently unavailable."

SEE ALSO: 7 Gadgets for the Ultimate Connected Living Room



Popularity (1/-1)

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# Outline

- Competition information
- **Method**
- Evaluation metric
- Report & Show off
- Precautions

# Method - Feature Engineering

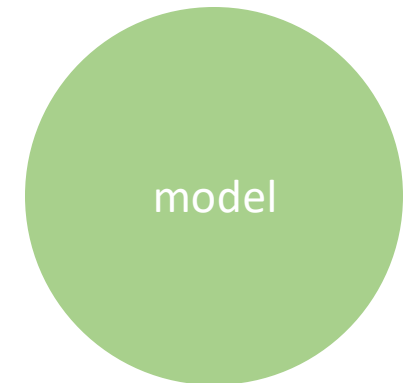
- The act of extracting features from raw data and then transforming them into something that we can use for a machine learning model.

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Raw Data



Feature Engineering



Classification

# Method - Feature Engineering

- Data preprocessing
- Convert words to vectors



# Method - Feature Engineering

- Data preprocessing
- Convert words to vectors

# Data Preprocessing

- Process HTML tags
  - Install **Beautiful Soup** to remove HTML tags
  - Select the specific tags

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Image courtesy of Saad Faruque  
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# Data Preprocessing

- Process HTML tags
  - Install **Beautiful Soup** to remove HTML tags
  - Select the specific tags

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Extract <h1>

```
<h1 class="title">OUYA Gaming Console Already Sold Out on Amazon</h1>
```

# Data Preprocessing

- Stop words
  - Stop words are common in a document but less information, they might misleading the classification model.
  - You can use the stop words **NLTK** provided or create your own stop words.

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "you've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'll", 'these', 'those', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do', 'does', 'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'while', 'of', 'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through', 'during', 'before', 'after', 'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both', 'each', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'not', 'only', 'own', 'same', 'so', 'than', 'too', 'very', 's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 'now', 'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn', "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'weren', "weren't", 'won', "won't", 'wouldn', "wouldn't"]
```

# Data Preprocessing

- Word stemming
  - The process of reducing inflected (or sometimes derived) words to their word stem, e.g. runs, running, ran => run.
  - NLTK provides two kind of algorithms to reduce the inflected words.



Porter Stemmer



Lemmatization

# Feature Engineering

- Data preprocessing
- Convert words to vectors

# Convert Words to Vectors

- Bag of words (BOW)
- Term frequency-inverse document frequency (TF-IDF)
- Feature hashing

# Convert Words to Vectors

- Bag of words (BOW)
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# Bag of Words

- A simple way of representing text data used in natural language processing and information retrieval.

Bag of words (BoW)

Very good drama although it appeared to have a few blank areas leaving the viewers to fill in the action for themselves. I can imagine life being this way for someone who can neither read nor write. This film simply smacked of the real world: the wife who is suddenly the sole supporter, the live-in relatives and their quarrels, the troubled child who gets knocked up and then, typically, drops out of school, a jackass husband who takes the nest egg and buys beer with it. 2 thumbs up... very very very good movie.



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(',', 5),  
( 'very', 4),  
( '.', 4),  
( 'who', 4),  
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Document

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Throw all the words into the bag

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Record how many times each word appear in the document


# Bag of Words

- Example

Review 1: This movie is very scary and long

Review 2: This movie is not scary and is slow

Review 3: This movie is spooky and good



	1 This	2 movie	3 is	4 very	5 scary	6 and	7 long	8 not	9 slow	10 spooky	11 good	Length of the review(in words)
Review 1	1	1	1	1	1	1	1	0	0	0	0	7
Review 2	1	1	2	0	0	1	1	0	1	0	0	8
Review 3	1	1	1	0	0	0	1	0	0	1	1	6

Vector of Review 1: [1 1 1 1 1 1 1 0 0 0 0]

Vector of Review 2: [1 1 2 0 0 1 1 0 1 0 0]

Vector of Review 3: [1 1 1 0 0 0 1 0 0 1 1]

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# Convert Words to Vectors

- Bag of words (BOW)
- Term frequency-inverse document frequency (TF-IDF)
- Feature hashing

# TF-IDF

- A numerical statistic that intended to reflect how important a word is to a document in a collection or corpus.
- The tf-idf value increases proportionally to the number of times a word appears in a document and is offset by the number of documents in the corpus that contain the word.



# TF-IDF

- Term frequency (tf)

- It is a measure of how frequently a term appears in a document

- $tf_{i,j} = \frac{n_{i,j}}{\sum_k n_{k,j}} = \frac{\text{Number of times term } i \text{ appears in the document}}{\text{Total number of terms in the document}}$

- Inverse document frequency (idf)

- It is a measure of how important a term is

- $idf_i = \log\left(\frac{|D|}{|\{j: t_i \in d_j\}|}\right) = \log\left(\frac{\text{Total number of documents}}{\text{Number of documents with term } i \text{ in it}}\right)$

- $tf-idf_{i,j} = tf_{i,j} * idf_i$

# Convert Words to Vectors

- Bag of words (BOW)
- Term frequency-inverse document frequency (TF-IDF)
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# Feature Hashing

- Reduce the dimension vocabulary space by hashing each vocabulary into a hash table with a fixed number of buckets.
- There are some cons, e.g. the information will be less than TF-IDF.
- However, you can do out-of-core learning when using hashing which means you only load part of the dataset at a time similar to the concept of batch.

# Outline

- Competition information
- Method
- **Evaluation metric**
- Report & Show off
- Precautions

# Evaluation Metric

- We will use **Area Under Curve (AUC)** as our metric in this competition.
- AUC is the area under the ROC curve.

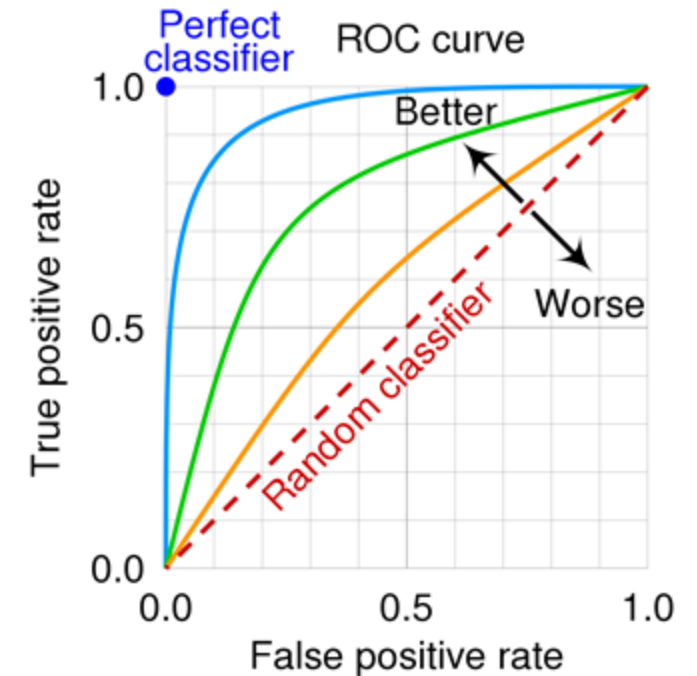
# Evaluation Metric

- Confusion matrix
  - A specific table layout that allows visualization of the performance of an algorithm.

	Actually Positive (1)	Actually Negative (0)
Predicted Positive (1)	True Positives (TPs)	False Positives (FPs)
Predicted Negative (0)	False Negatives (FNs)	True Negatives (TNs)

# Evaluation Metric

- Receiver operating characteristic curve (ROC curve).
  - A graphical plot that illustrates the diagnostic ability of a binary classifier system as its discrimination threshold is varied.
  - False positive rate =  $\frac{\text{False positive}}{\text{All negative samples}}$
  - True positive rate =  $\frac{\text{Ture positive}}{\text{All positive samples}}$



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# Report

- **Each team** has to hand in a report after the competition ends.
- The report should be in the form of a **Jupyter Notebook**.
- The filename should be DL\_comp1\_{student ID}\_report.ipynb
- Please submit your report via the **eeclass** system **before 2024/10/27**.

# Report

- The report should include:
  - Student ID & name of each member
  - How did you preprocess the data
    - E.g. cleaning, feature engineering
  - How did you build the classifier
    - E.g. model, training algorithm, special techniques
  - Conclusion
    - E.g. interesting findings, pitfalls, takeaway lessons

# Show off

- For the **top three scores** on the private leaderboard, a show off event will be held during the class on **2024/10/24**.
- For the top three students, please prepare a brief presentation (about 3 to 5 minutes) to introduce your **feature design, model, methods tried and experiment results**.
- Please prepare slides. Don't present directly with your code.

# Outline

- Competition information
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- **Precautions**

# Precautions

- Timeline:
  - 2024/09/26 (Thur) - competition announced
  - 2024/10/22 (Thur) 23:59pm - competition deadline
  - 2024/10/27 (Sun) 23:59pm - report deadline (to eeclab)
  - 2024/10/24 (Thur) - show off (TOP 3)
- Scoring:
  - Private leaderboard - 80%
  - Report - 20%

# Precautions

- Rules
  - What you **CAN** do
    - Use untaught APIs: you can use any machine learning tools you like as well as models/techniques that are not taught in the class.
  - What you **CAN'T** do
    - Create specific deterministic rules that make predictions.
    - Train models using representation learning based on neural networks.
    - Use datasets and references beyond those made available by the competition.
    - Abuse the competition infrastructure to gain an edge.
    - Copy code from other teams.