Workshop

Text Classification for the Arabic Language

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GDG Kuwait

Women Techmakers

THE INFORMATION SCIENCE LAB

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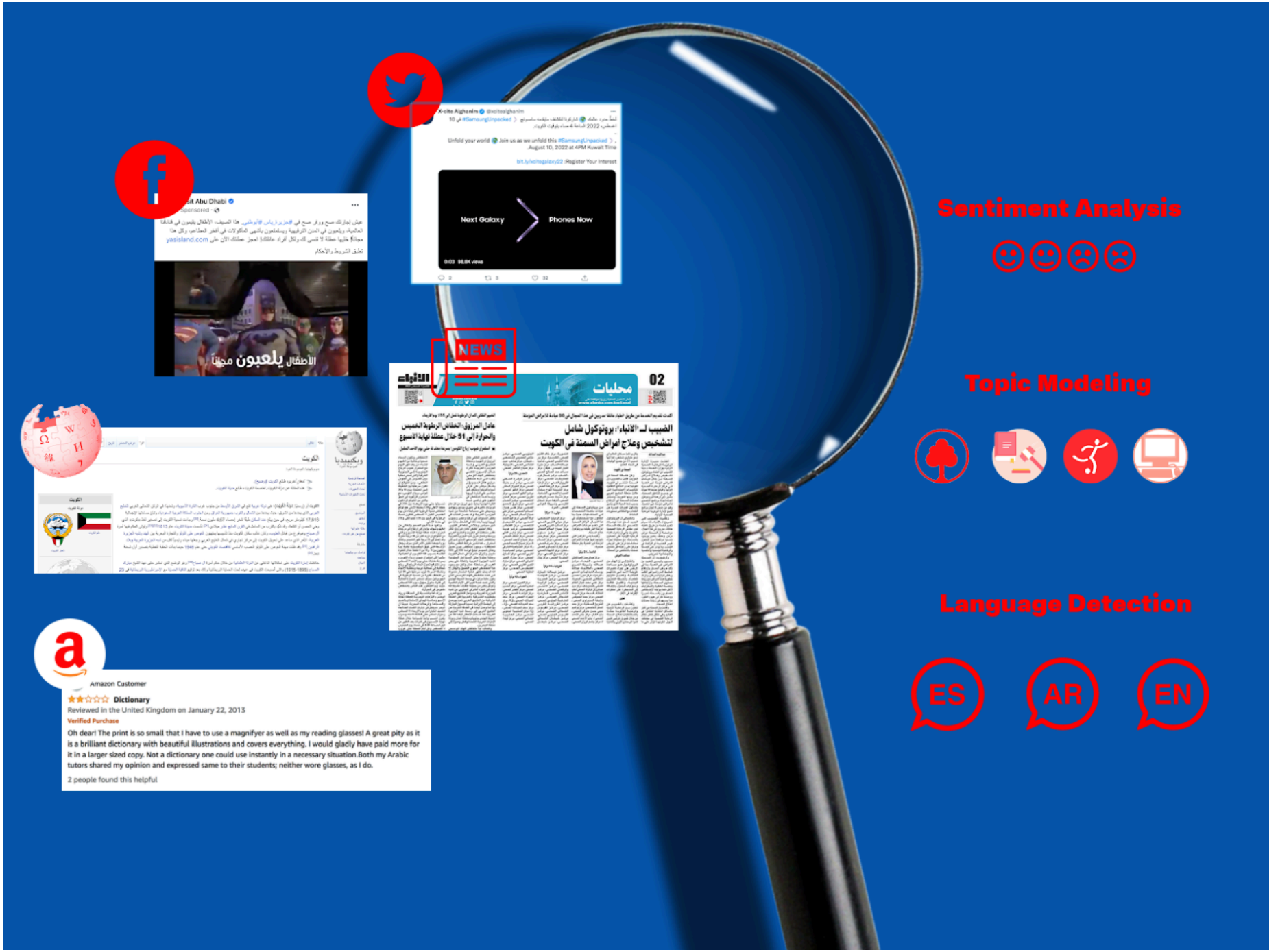
- Research: Arabic Natural Language Processing

- The Information Science Lab - https://infoscilab.ku.edu.kw

Agenda

- Introduction to text classification
- Selecting the dataset
- Exploratory data analysis
- Text preprocessing
- Preparing the dataset
- Feature extraction
- Classification model
- Performance evaluation
- Error Analysis

What is Text Classification?



Is this a Spam?

[From: Mrs. Suzanne Mubarak ...]

MM

Mrs. Suzanne Mubarak <mrssuzamubarak@gmail.com>

To: Recipients <mrssuzamubarak@gmail.com> Sun 7/10/2022 7:06 AM

Dear Friend,

I am Mrs. Suzanne Mubarak, the wife of deposed and now late Egyptian President Hosni Mubarak who was jailed by the government of Egypt. You must have heard over the media reports and the Internet on the discovery of some fund in my husband secret bank account and companies and the allegations of some huge sums of money deposited by my late husband in my name of which I have refused to disclose or give up to the corrupt Egyptian Government.

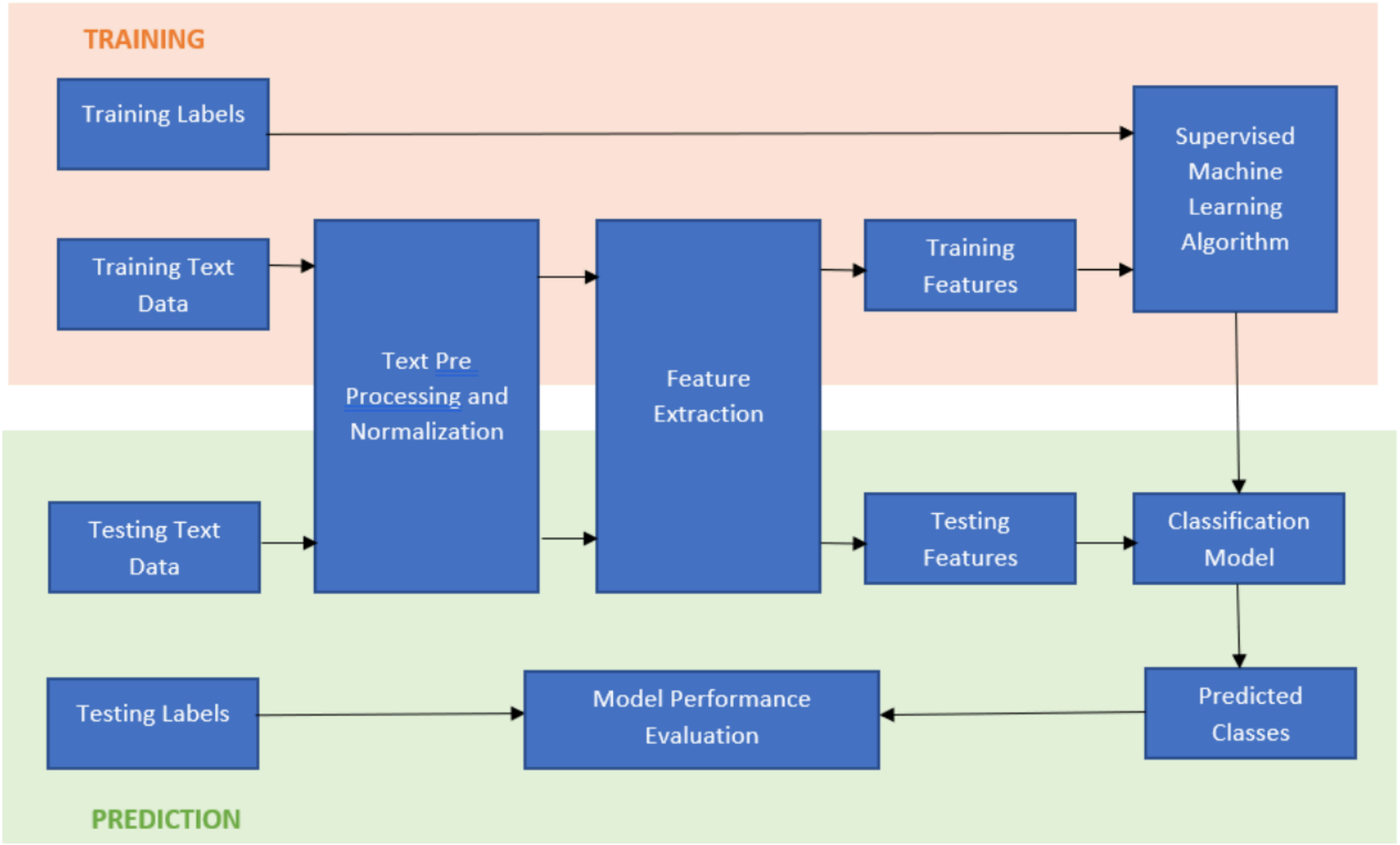
In fact the total sum allegedly discovered by the Government so far is in the amount of about $6.5 Billion Dollars. And they are not relenting on their effort to make me and my sons(Gamal & Alaa Mubarak) poor for life.

As you know, the Muslim community has no regards for women, more importantly when the woman is from a Christian background, hence my desire for a foreign assistance.

This arrangement will be known to you and I alone and all our correspondence should be strictly on email alone because our government

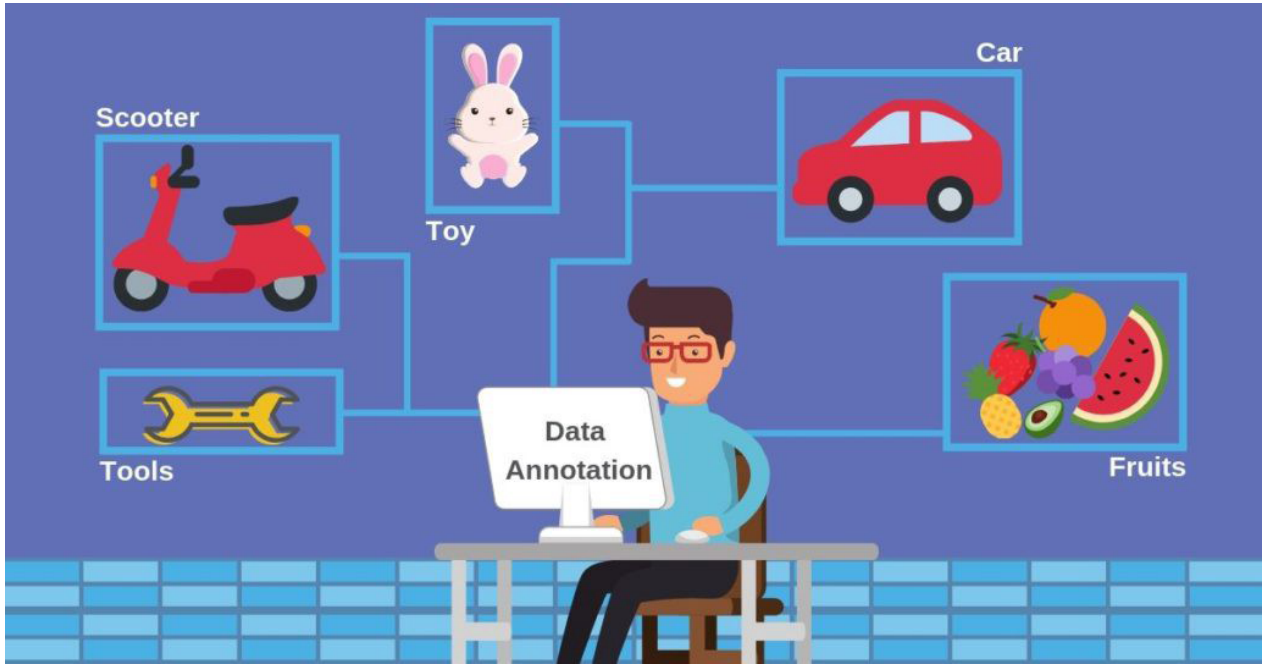
Is this an Offensive Language Tweet?

Text Classification Pipeline



Dataset Selection

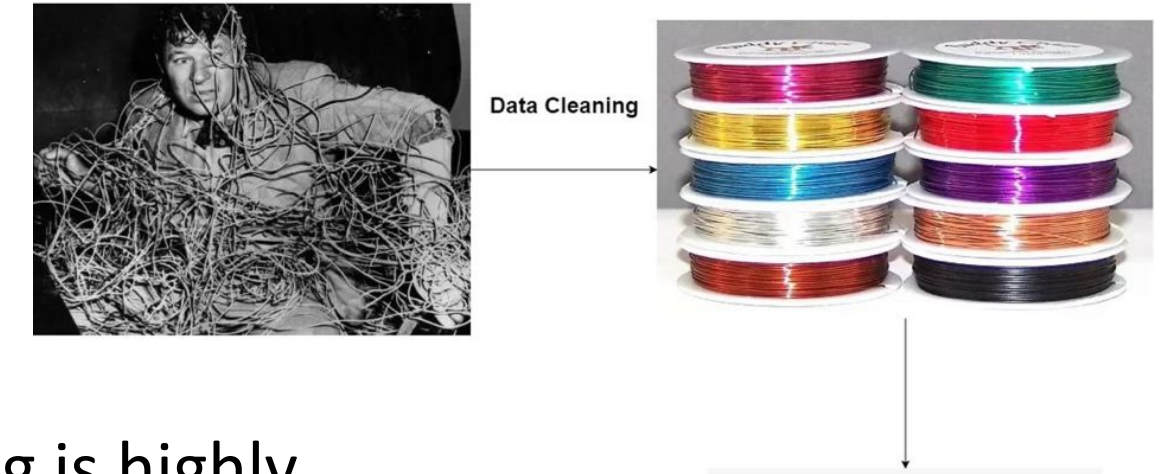
- Dataset sizes
- Distribution of samples (classes)
- Annotation of the datasets
- Source of the dataset



Exploratory Data Analysis

- Initial dataset investigation
- Help to discover patterns
- Help to understand the dataset
- Learn the main characteristics of the dataset

Text Preprocessing



- Raw documents without preprocessing is highly unstructured and contains redundant information.
- dimensionality reduction.
- Bring your text into a form that is **predictable** and **analyzable** for your task.
- Not directly transferable from task to task

Text Preprocessing

Emoji Conversion	
يا اتربيتوا عليها يا لأ😇 *you were raised on it or no*	يا اتربيتوا عليها يا لأ **وجه مبتسم مع هالة**

Dialects Normalization	
لا تعتب عليه هيدا اسمه ابو **صرماي** *Don't worry his name is shoe's owner*	لا تعتب عليه هيدا اسمه ابو **حذاء**

Text Preprocessing

Word Categorization	
بدل ما تخسر تبديل يا حمار *better than losing, donkey*	بدل ما تخسر تبديل يا **حيوان**

Letters Normalization	
يا أنت يا حبيبي يا أنيق *Lovely, you are elegant*	يا انت يا حببى يا انق

Text Preprocessing

Hashtags Segmentation	
نحبك يا تاج الرأس يا كل أيامنا أنت #يوم_الأم *We love you, you are our days mother's day*	نحبك يا تاج الرأس يا كل أيامنا أنت يوم الأم

Miscellaneous	
يا RT : @USER @USER نموت احرار يا نمشي ماليزيا *We either die free or we will leave to Malaysia*	نموت احرار نمشي ماليزيا

Dataset Preparation

- Partitioning the dataset
  - Train set - used in teaching the model
  - Validation/Development/Evaluation set - used for initial evaluation of the model’s parameters
  - Test set - used for testing the mode
- Converting labels to numeric format

Feature Extraction

- Numerical representation for individual words
- Word embeddings
- Assign particular weights to words that tell us how important they are in the document

Feature Extraction

- **Bag-Of-Words**: represents text as multisets (bags) without preserving the order of the words but keeping their frequencies.

	about	bird	heard	is	the	word	you
About the bird, the bird, bird bird bird	1	5	0	0	2	0	0
You heard about the bird	1	1	1	0	1	0	1
The bird is the word	0	1	0	1	2	1	0

Feature Extraction

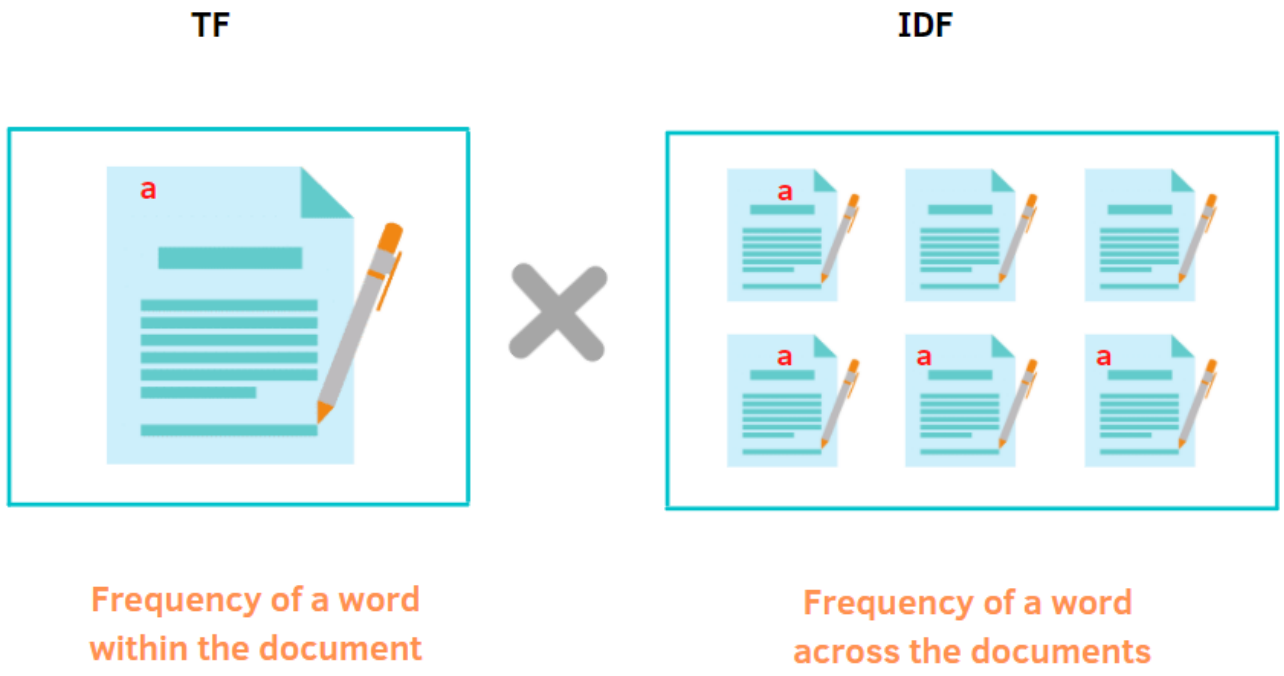
- **Term Frequency-Inverse Document Frequency (TF-IDF):** a form of sparse word embedding
- Provide semantic relationship between words in the vocabulary
- $\text{tf}_{t,d} = \log_{10}(\text{count}(t,d)+1)$
- df_t *is* the number of documents *t* occurs in

$$\text{idf}_t = \log_{10}\left(\frac{N}{\text{df}_t}\right)$$

N is the total number of documents in the collection

Feature Extraction

- Final tf-idf weighted value for a word $w_{t,d} = \mathrm{tf}_{t,d} \times \mathrm{idf}_t$



Classification Model Development

- Computers can teach themselves to use data and learn from their experiences to make more accurate decisions by using machine learning models
- A classification function to estimate the class for each instance
- Examples:
  - Naive Bayes is a generative classifier
  - Logistic regression is a discriminative classifier

Classification Model Development

Generative and **Discriminative** Classifiers

Suppose we're distinguishing cat from dog images

imagenet

imagenet

Resource: https://web.stanford.edu/~jurafsky/slp3/

Classification Model Development

Generative Classifier:

- Build a model of what's in a cat image
  - Knows about whiskers, ears, eyes
  - Assigns a probability to any image:
    - how cat-y is this image?

Also build a model for dog images

Now given a new image:

Run both models and see which one fits better

Resource: https://web.stanford.edu/~jurafsky/slp3/

Classification Model Development

Discriminative Classifier

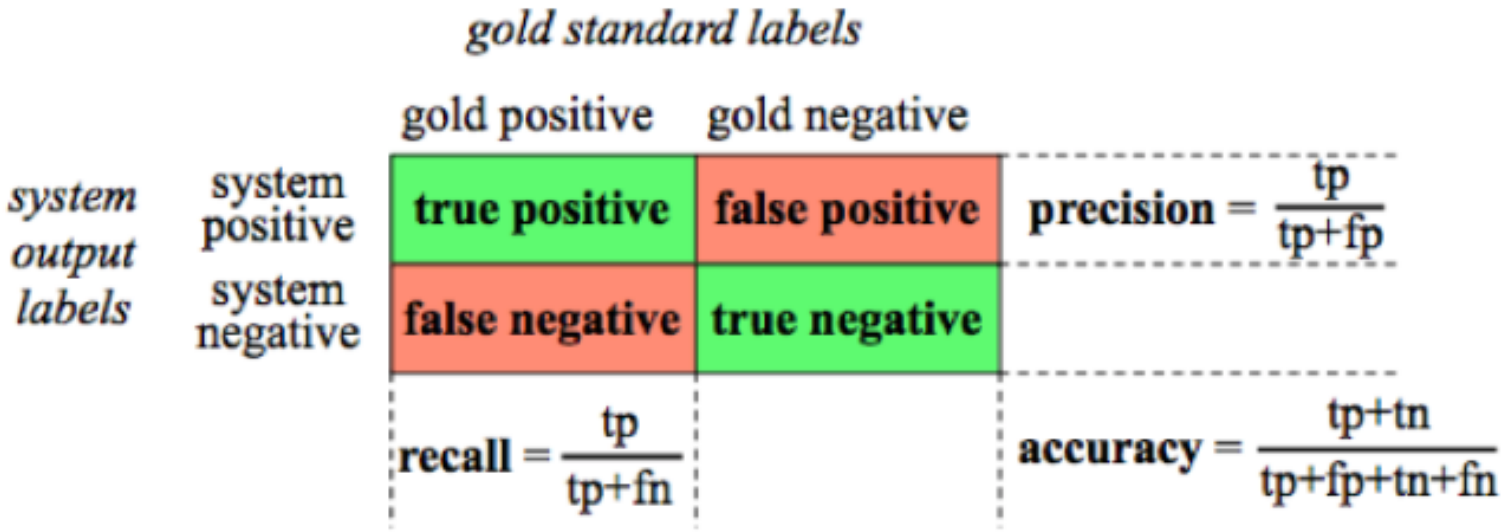
Just try to distinguish dogs from cats

Oh look, dogs have collars!
Let's ignore everything else

Resource: https://web.stanford.edu/~jurafsky/slp3/

Performance Evaluation

- **Precision**: how many of the returned labels are correct
- **Recall**: how many of the labels that should have been returned are actually returned
- **Accuracy**: the classifier does what it is supposed to do



Performance Evaluation

- **F1 measure** : a balance between the quantity and the quality of labels

$$F1 = \frac{2 * (Precision * Recall)}{(Precision + Recall)}$$

Error Analysis

- Manually looking at the errors (the examples in the validation dataset that the simple algorithm doesn’t work properly) to generate more insights.
- Try different ideas and cross-check whether they are improving your application or not

Project: Offensive Language Detection

- Login to your Gmail
- Download the Jupyter Notebook (Text Classification Basics - Workshop) from this repository:

- https://github.com/Fatemah-Husain

- Start a new Colab project using the same file and follow its instruction.