# Apple and Google products - Twitter Sentiment Analysis

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**What is sentiment analysis?**

Sentiment analysis refers to identifying as well as classifying the sentiments that are expressed in the text source.
It aims to analyze people's sentiments, attitudes, opinions emotions, etc. towards elements such as, products, individuals, topics ,organizations, and services

# What is the problem? Why Twitter?

**The problem is to understand your audience, keep on top of what's being said about your brand – and your competitors – but also discover new trends in the industry.**

Twitter sentiment analysis allows you to keep track of what's being said about your product or service on social media, and can help you detect angry customers or negative mentions before they they escalate.

The most popular international microblogging website

Wide variety of audience from regular man to celebrity

Short text message - 140 characters - reduce processing time, unambiguous
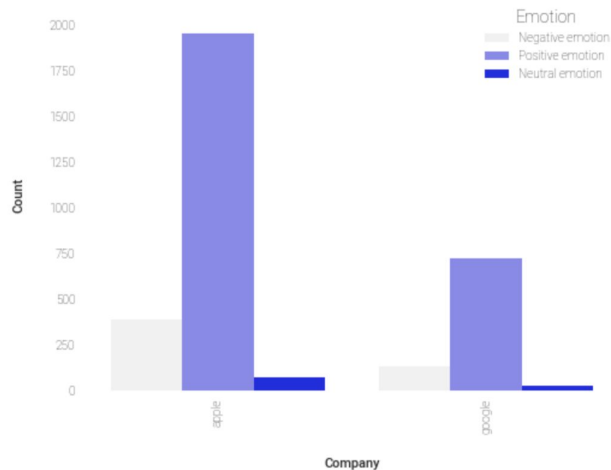
240B+ active users 500M tweets a day

Various subjects

# Twitter Data

Data overview: The dataset which is used to train the model contains almost 10,000 tweets about Apple and Google devices and services.
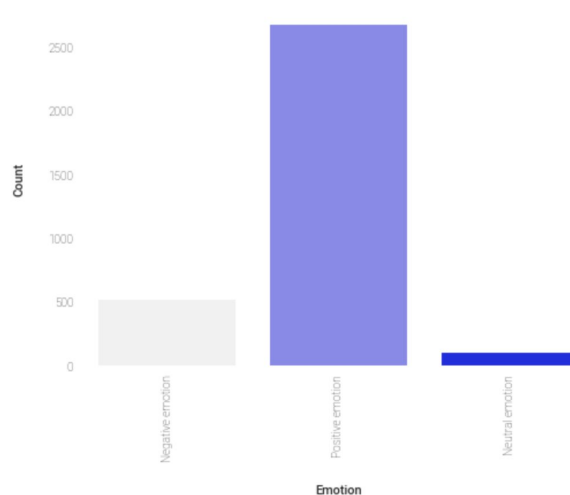


## Sentiment by Company
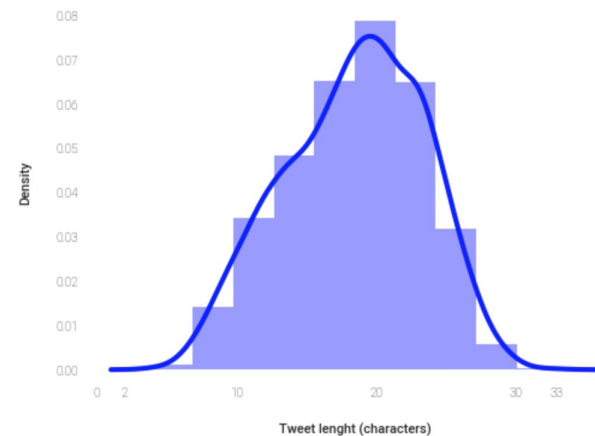Bar plot of class distribution

## Class Distribution
Bar plot of class distribution

## Tweets Characteristics - Lenght
Distribution plot of tweets lenghts

Source: tweet_product_company.csv

# Data transformation - Text Vectorization

In order to make text useful for the machine learning algorithms, ithas to be turned into features.
The techniques can be referred to as "*Text Vectorization*", since they all aim at one purpose: turning text into vectors, that can be then fed to machine learning models in a classical way.

|   | tweet_text | product | label |
|---|---|---|---|
| 0 | .@wesley83 I have a 3G iPhone. After 3 hrs twe... | iPhone | Negative emotion |
| 1 | @jessedee Know about @fludapp ? Awesome iPad/i... | iPad or iPhone App | Positive emotion |
| 2 | @swonderlin Can not wait for #iPad 2 also. The... | iPad | Positive emotion |
| 3 | @sxsw I hope this year's festival isn't as cra... | iPad or iPhone App | Negative emotion |
| 4 | @sxtxstate great stuff on Fri #SXSW: Marissa M... | Google | Positive emotion |

```
array([[5869,   23,   51, ..., 3955,    6,    1],
       [   0,    0, 5870, ..., 3956,    6,    1],
       [   0,    0,    0, ...,  208,    6,    1],
       ...,
       [   0,    0,  110, ...,   16,    1, 2452],
       [   0,  157,  687, ...,  143, 2546,    1],
       [   0,    0,    0, ...,    6,    1,    4]], dtype=int32)
```

```
array([[ 0.        ,  0.        ,  0.        , ...,  0.        ,
         0.        ,  0.        ],
       [ 0.32527   ,  1.20930004,  0.15962   , ..., -1.10020006,
        -0.91891003,  0.48025   ],
       [ 1.21739995,  1.01839995, -0.60869998, ..., -0.88479   ,
         0.58089   , -0.09434   ],
       ...,
```

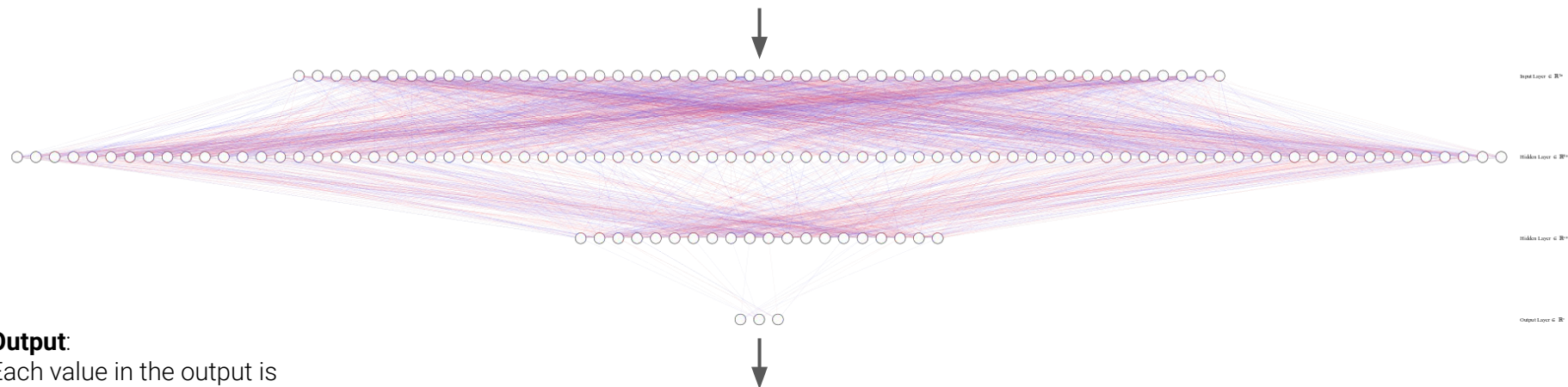*Above: sample of the twitter dataset*
*Right: Dataset converted to arrays*

# Model architecture

3-way classification of tweets content using Neural Networks and Natural Language Processing (NLP)

**Input**

```
array([[5869,   23,   51, ..., 3955,    6,    1],
       [   0,    0, 5870, ..., 3956,    6,    1],
       [   0,    0,    0, ...,  208,    6,    1],
       ...,
       [   0,    0,  110, ...,   16,    1, 2452],
       [   0,  157,  687, ...,  143, 2546,    1],
       [   0,    0,    0, ...,    6,    1,    4]], dtype=int32)
```



Input Layer ∈ ℝ⁷⁰

Hidden Layer ∈ ℝ⁶⁴

Hidden Layer ∈ ℝ³²

Output Layer ∈ ℝ³

**Output**:
Each value in the output is interpreted as the probability of membership for each class.

```
{0: 'Negative emotion', 1: 'Neutral emotion', 2: 'Positive emotion'}
     [[0.04 0.47 0.49]] [ 2 ] Positive emotion
```

# Real time sentiment monitoring

Data can be fed into the trained model in real time through various tools i.e Twitter API or Python libraries and instantly generate insights about a brand or service.



## Sentiment by Company
Bar plot of class distribution

Source: tweet_product_company.csv
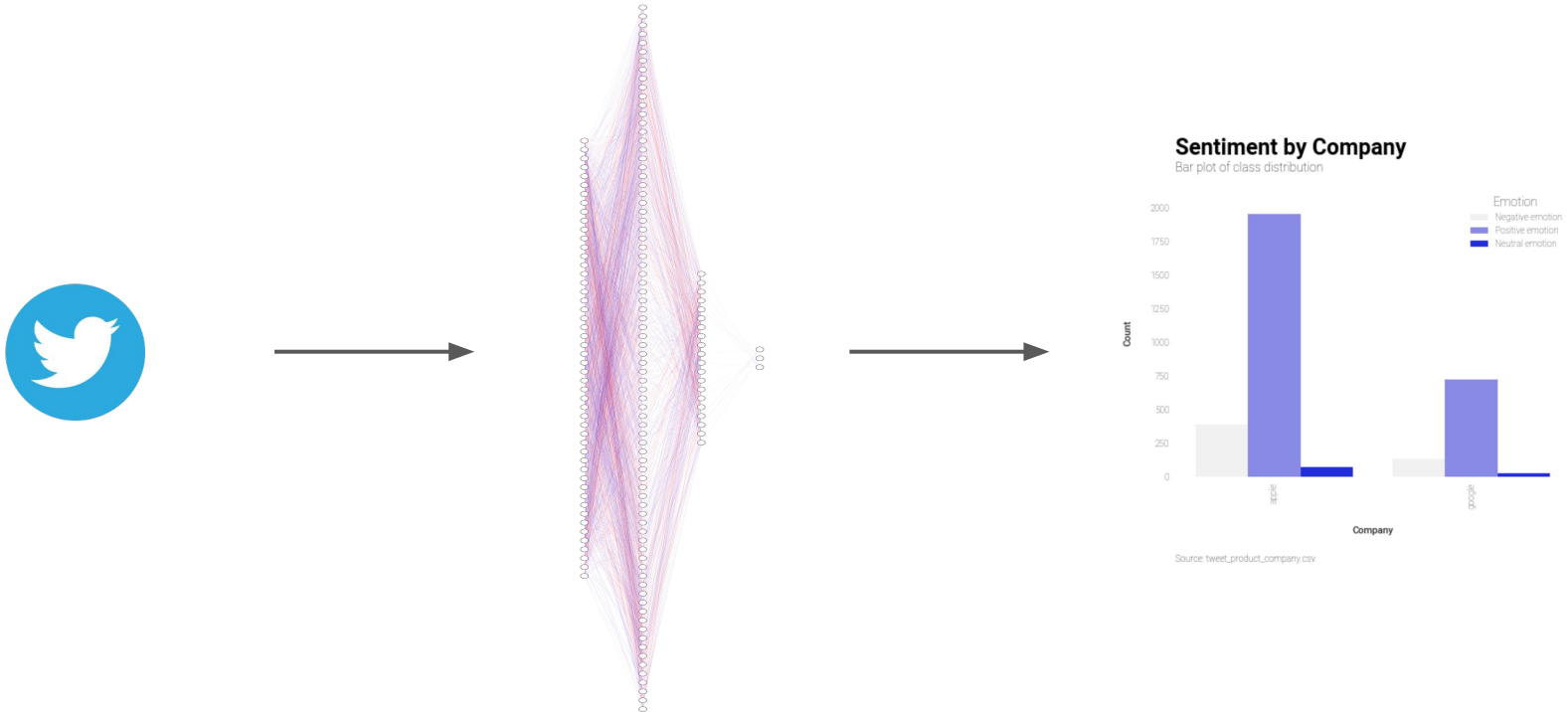
# Model results and future improvements

Confusion matrix reflects the accuracy of the predictions.



Normalized confusion matrix
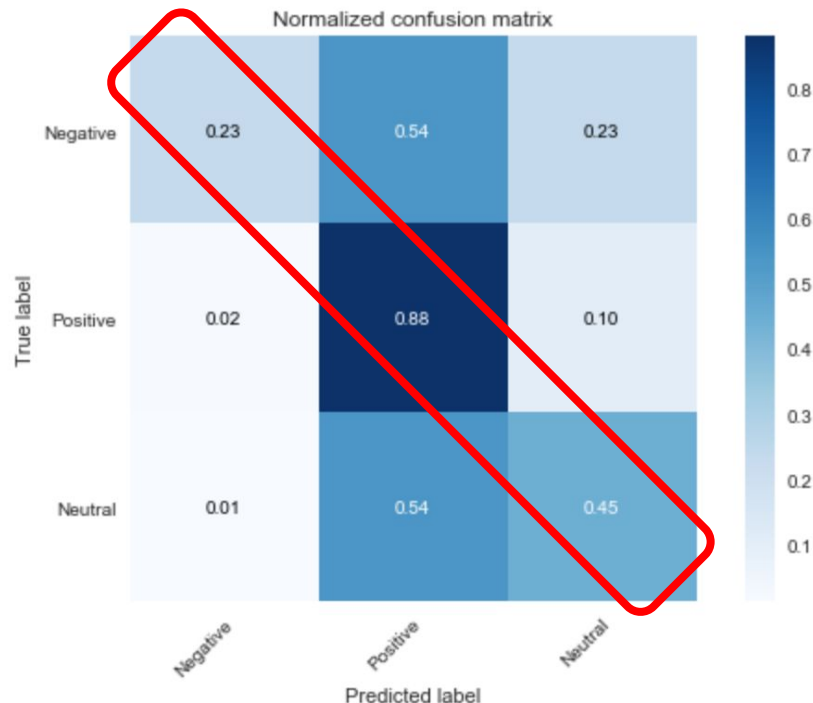
- In the red highlight we can see the percentages of the correct predictions. i.e. 88% for the positive emotion.
- The lower accuracy for the other classes is a results of insufficient data.
- If there was more time and data, the following further improvements to the model could be done:
  - Model accuracy for the negative and neutral labels
  - More advanced data visualizations and analysis
  - Model deployment

**General model accuracy: 70%**

# Twitter Sentiment Analysis Use Cases

Twitter sentiment analysis provides many exciting opportunities. Being able to analyze tweets in real-time, and determine the sentiment that underlies each message, adds a new dimension to social media monitoring.

### Social Media Monitoring

Twitter sentiment analysis allows you to keep track of what's being said about your product or service on social media, and can help you detect angry customers or negative mentions before they they escalate.

### Customer Service

How can you detect which support queries are most urgent? Twitter sentiment analysis allows you to track and analyze all the interactions between your brand and your customers, so you can make sure you respond to the most critical issues first.

### Market Research

Twitter is a major source of consumer insight. Understanding what customers like, what their behaviors are, and how this changes over time is essential if you are planning to launch a new product.

### Brand Monitoring

Whether you are launching a new feature on your platform, a site redesign, or a new marketing campaign, you may want to track customer reactions on Twitter.

### Political Campaigns

A huge part of Twitter conversation revolves around news and politics. That makes it an excellent place to measure public opinion, especially during election campaigns.

# Thank you!

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References:
- *https://monkeylearn.com/blog/sentiment-analysis-of-twitter/*
- *Softmax Activation Function with Python - Machine Learning ...https://machinelearningmastery.com › Blog*
- *http://alexlenail.me/NN-SVG/index.html*