# SENTIMENT ANALYSYS ON METAVERSE

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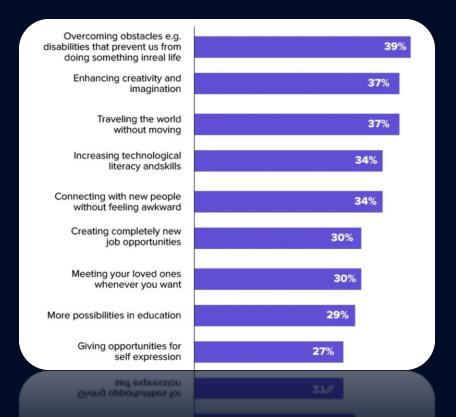
# Introduction

Data collected from social media can reveal important information about the thoughts of society towards a certain topic, event, or situation. One of the platforms where people typically express feelings about topics is Twitter, and tweets' analysis can be a useful tool to determine people's feelings.
We focused on determining the feelings and sentiments around

*Metaverse*

By definition, the metaverse is a vast network where individuals can interact socially and professionally via their avatars , invest in cryptocurrencies and NFTs to own unique meta-wearables and virtual lands, take classes, work, and travel in 3-D virtual reality.

# Metaverse's Benefits

# Metaverse's Key Actions & Concerns

Over the past years, the metaverse is growing fastly and while the metaverse hype continues to rise, companies interested in activating virtually should take precautions on satisfying correctly potential customers.

## Key Actions

Understanding key actions of other companies that obtained positive sentiment

## Lesson Learned

Understanding concerns of users on companies in this market could allow us to avoid their same errors

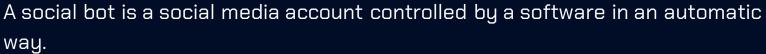# Table of contents

# 01
# Data Collection

# Twitter's API & snscrape

In our study, we 've started collecting twitter posts containing the hashtag *#metaverse*. For this aim, snscrape tool has been used, a Python library that can be used to scrape tweets bypassing the Twitter's restricting API policies. In this way even tweets in the remote past can be easily collected.
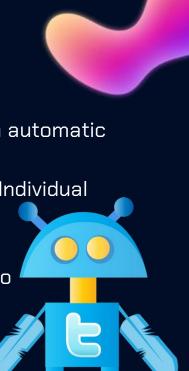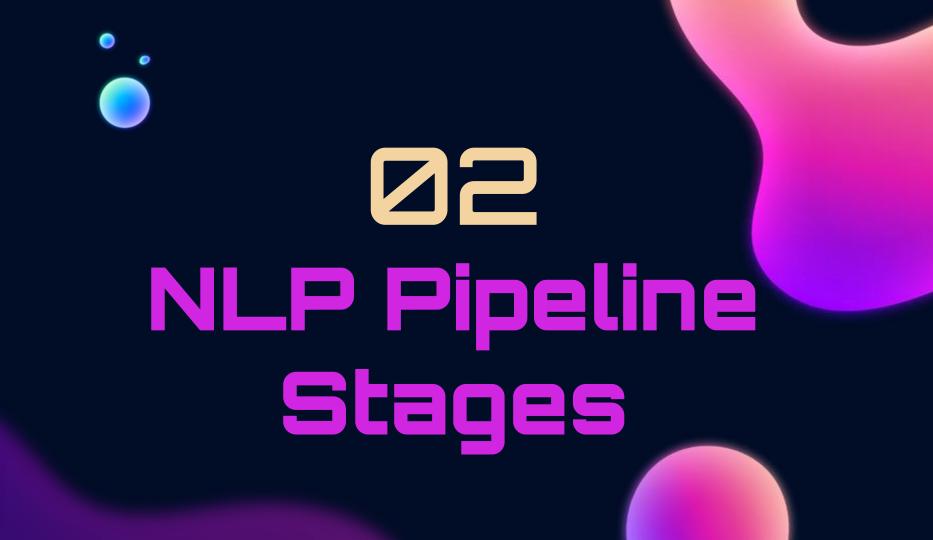
# Botometer

A social bot is a social media account controlled by a software in an automatic way.
Bot detection can be accomplished in different ways, one of this is Individual Bot Detection.

Digitare l'equazione qui.

*Botometer* is an ensemble of Random Forest classifiers taking in input more than 1200 features and provide a probability for a user to be a bot, with an accuracy close to 90%.
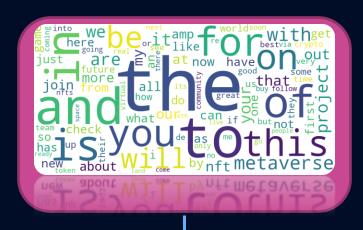
*Threshold = 0.6*

# 02
# NLP Pipeline Stages

# NLP Pipeline

- Removal of URLs
- Removal of Twitter Handlers
- Removal of hashtags
- Removal of special characters and single characters

## Data Cleaning



## Tokenization

Process of breaking down a text into the smallest unit of sentence, or token.

# NLP Pipeline



## Normali zation

Process of translation in lowercase text and the removal of accented characters.

## Filtering

Process involving the removal of stop words and short words.

# NLP Pipeline



## Stemming

Process of reducing inflected words in their stem form.

# 03
# Sentiment Analysis

# TextBlob – Polarity & Subjectivity

*TextBlob* is a Python library for processing textual data. It provides a simple API for diving into common natural language processing (NLP) tasks. When a sentence is passed into TextBlob returns a polarity and subjectivity metric for each tweet.
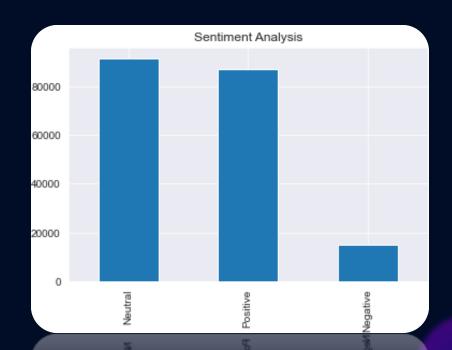
# TextBlob

$$Sentiment = \begin{cases} Positive & if\ polarity > 0 \\ Neutral & if\ polarity == 0 \\ Negative & if\ polarity < 0 \end{cases}$$
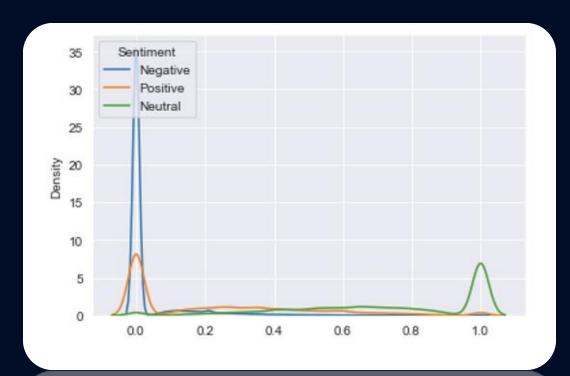


Sentiment Analysis

# TextBlob

# Sentiment Intensity Analyzer (SIA)

*VADER* (Valence Aware Dictionary and sEntiment Reasoner) is a lexicon and rule-based sentiment analysis tool that is specifically attuned to sentiments expressed in social media.

It returns for each tweet post a polarity score that can then be divided into a Positive Sentiment Score, Negative Sentiment Score and Neutral Sentiment Score, each varying in the range [0,1] and all present for each tweet.

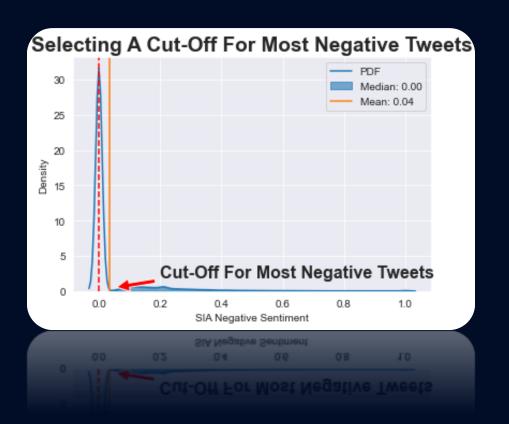| TweetID | … | Positive Sentiment | Neutral Sentiment | Negative Sentiment |
|---------|-----|-----|-----|-----|
| ….. | ….. | 0.003 | 0.345 | 0.786 |
| ….. | ….. | ….. | ….. | ….. |

# Classification

We've decided also to consider classification task in order to implement also a domain-specific classifier. For this aim, we've manually labeled a subset of tweets in order to have a ground-truth.
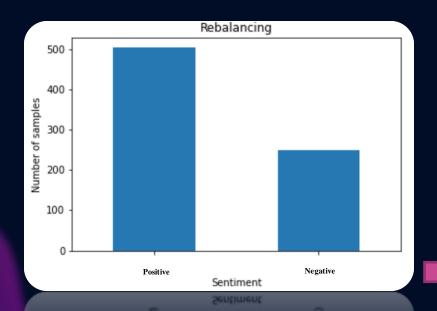


Positive
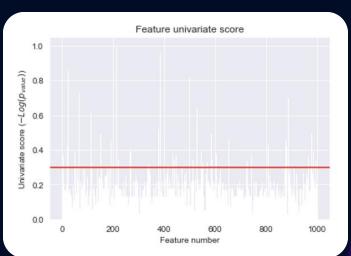


Negative

# Rebalancing



SMOTE

# Feature Selection

Univariate feature selection works by selecting the best features based on univariate statistical tests. We've used F-test for feature scoring to select the most significant features and *SelectKBest* as transform method, removing all but the *k* highest scoring features.
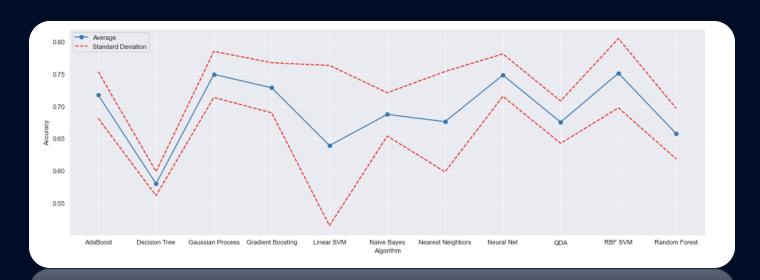
$$Univariate\ Score\ =\ -Log(pvalue)$$

# Classifiers Comparison

We've evaluated different classifiers using the accuracy as evaluation metric and a K-Fold Cross Validation with K = 10.
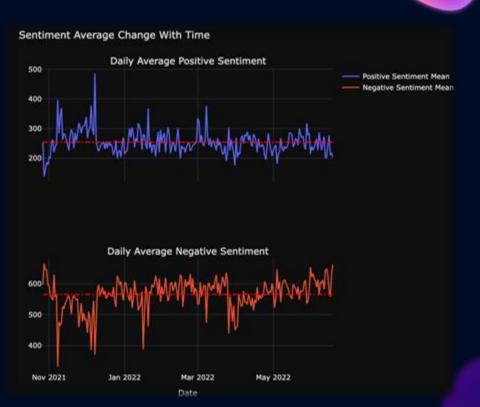
# Classifiers Comparison

| Algorithm | Mean Accuracy | Std Accuracy |
|---|---|---|
| AdaBoost | 0.72 | 0.04 |
| Decision Tree | 0.58 | 0.02 |
| Gaussian Process | 0.75 | 0.04 |
| Gradient Boosting | 0.73 | 0.04 |
| Linear SVM | 0.64 | 0.13 |
| Naive Bayes | 0.69 | 0.03 |
| Nearest Neighbors | 0.68 | 0.08 |
| Neural Net | 0.75 | 0.04 |
| QDA | 0.68 | 0.03 |
| RBF SVM | 0.75 | 0.05 |
| Random Forest | 0.65 | 0.03 |
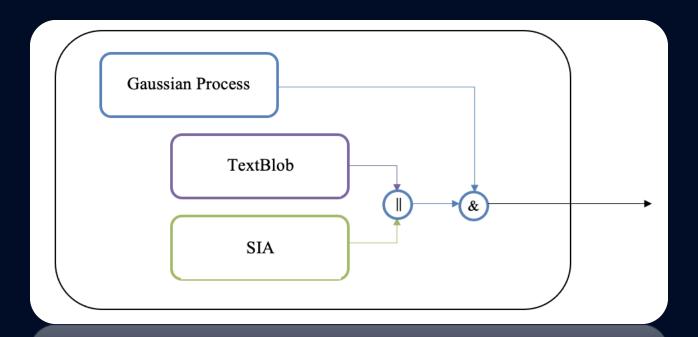
# Best Classifier Results
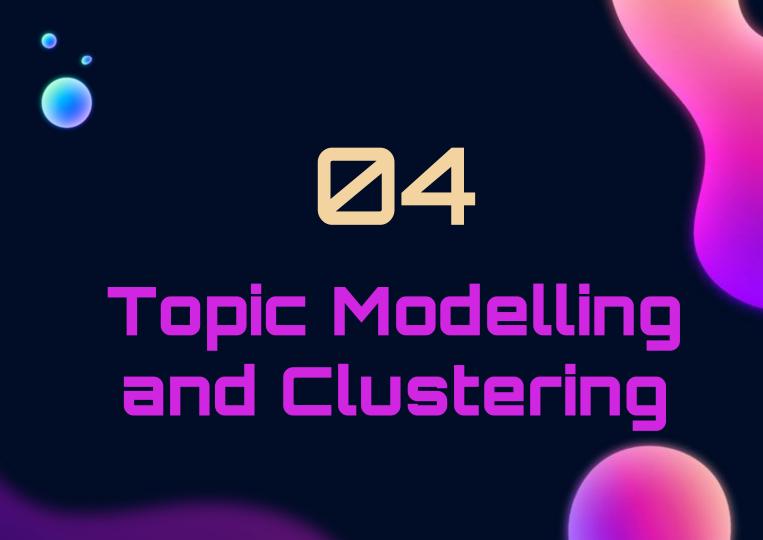
| Algorithm | Mean Accuracy | Std Accuracy |
|-----------|---------------|--------------|
| Gaussian Process | 0.75 | 0.04 |

# Ensemble Learning

# 04

# Topic Modelling and Clustering
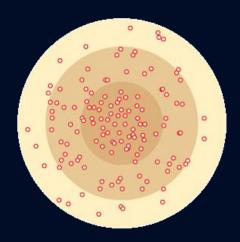
# Topic Modelling Algorithms

LDA

LSA

Umass Coherence

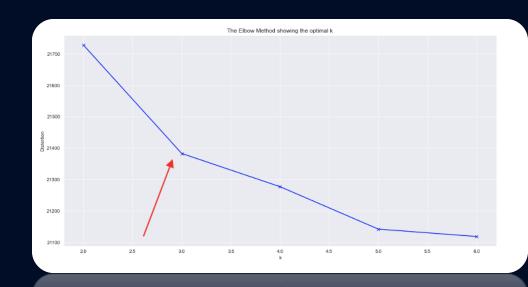$$score(v_i, v_j, \epsilon) = \log \frac{D(v_i, v_j) + \epsilon}{D(v_j)}$$

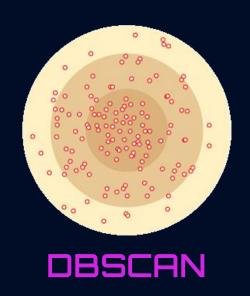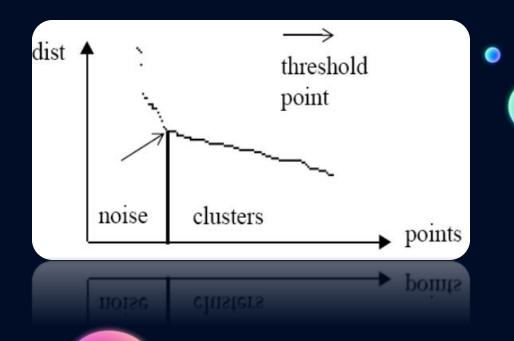# Clustering Algorithms



K-Means

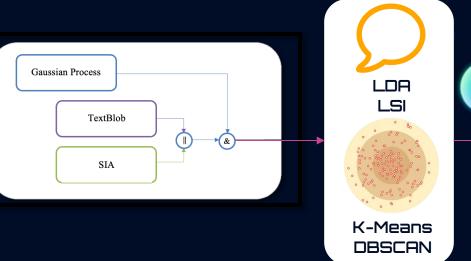The Elbow Method showing the optimal k

# Clustering Algorithms



DBSCAN

$$MinPts = 2 * NumFeatures$$

# 05

## Results
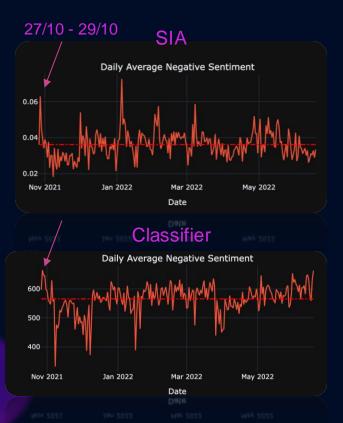
# Results

# Facebook's Rebranding in Meta

# Facebook's Rebranding in Meta



27/10 - 29/10

SIA

Daily Average Negative Sentiment

Classifier

Daily Average Negative Sentiment

🐦 *"Is @Facebook rebranding following a series of negative stories about itself or because it's building a #Metaverse?"*

🐦 *"Either meta or facebook, it still doesn't eliminate the mess the vulnerability and the lack of users' privacy protection. Mark zuckerberg is ignoring the real issues and doing name rebranding"*

🐦 *"#meta is a distraction and barely news worthy. Facebook has died. They just trying to raise that dinosaur from the grave. 🦕 🦕 🦕 🦕 🦕"*

🐦 *"#MetaVerse as a caution not as a future opportunity for #MarkZuckerberg to change subjects and evade responsibility for @Facebook damaging democracy."*

# ENS's Airdop, Disney's Business Idea, IOEN's peak

08/11-12/11

SIA

LDA



Classifier

# ENS's Airdop, Disney's Business Idea, IOEN's peak
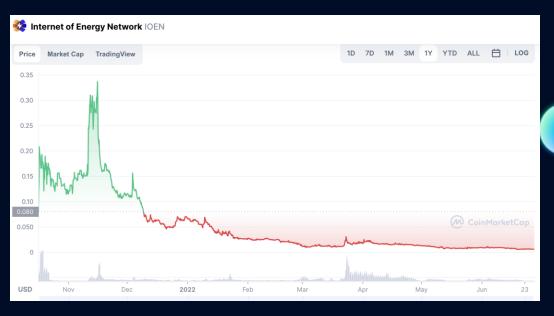
08/11-12/11

**SIA**



**Classifier**



1. Disney's CEO announcement that the company would invest "to connect the physical and digital worlds even more closely, allowing for storytelling without boundaries in our own Disney metaverse"

2. ENS started the airdrop of ENS tokens to the holders of Ethereum wallet addresses. ENS tokens allow users to vote for executable and constitutional proposals inside the organization

3. IOEN, a crypto token whose goal is to be used as a staking asset to unlock new microgrid economies, reached its maximum in price leading to a consistent number of positive reactions on Twitter

# NFT.com whitelist

SIA



Sentiment Average Change With Time

Daily Average Positive Sentiment

26/03-02/04

Classifier



Sentiment Average Change With Time

Daily Average Positive Sentiment

K-Means



digital coming train community discord starting whitelist marketplace launchpad worldfirst

# NFT.com whitelist

SIA



26/03-02/04

Classifier



NFT.com marketplace for non-fungible tokens announced that more than ten thousand users asked to be part of their whitelist. Being part of the whitelist has been necessary for users in April that wanted to participate in the Genesis Key Whitelisted auction.

Genesis Keys are a collection of 10.000 unique fully animated NFTs, and their owners had first access to the NFT.com platform and can provide participation in its governance. Each key grants a holder to create two unique NFT.com profiles, also represented as NFTs.
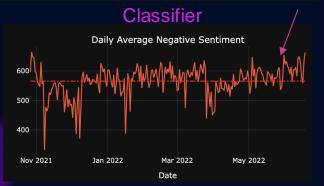
# Terra's Ecosystem Crash

# Terra's Ecosystem Crash



SIA

14/05 - 18/05



Classifier

🐦 "@SynthwaveManaic @Domi14253851 @stablechen #luna this luna project is faulty, (luna2.0. Let's take out a new one, if not, we will release luna3.0) … there is no end to it... Because of luna, people now view crypto as a scam #web3 #metaverse etc... the whole market crashed"

🐦 "Everbody write Luna is scam binance is scam. Because you are Real power #binance #luna #Web3 #Terra_Luna #BSC #NFTs #BTC #Metaverse"

🐦 "These @terra_money idiots can't see the #LUNA community is committed to buy this project back up to respectability because they have no desire to make wise choices"

# Conclusion

Our sentiment analysis tool may be useful for new companies ready to launch in this new ecosystem understanding in advance needs and concerns of users. This study has been conducted on the general topic of Metaverse. More detailed results may be obtained from a company by conducting an analysis on metaverse's posts within their business area.

Get ready for the new world!