Fortune Medical Associates
(Predicting Drug Results)

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NLP Project

Agenda

- Business Objective
- Data Understanding
- EDA (Visualization)
- Models
- Topic Modeling
- Conclusion

Business Objective:

Our Stakeholder wants to predict Drug results based on patient's reviews.

- Positive Effect (Patient sent positive rating review)
- Negative (No) Effect (Patient sent negative rating review)

Our stakeholder's Main focus was to take care of Negative reviews, so they can follow up with patient to diagnose why Drug failed to work, which improve their Business reviews.

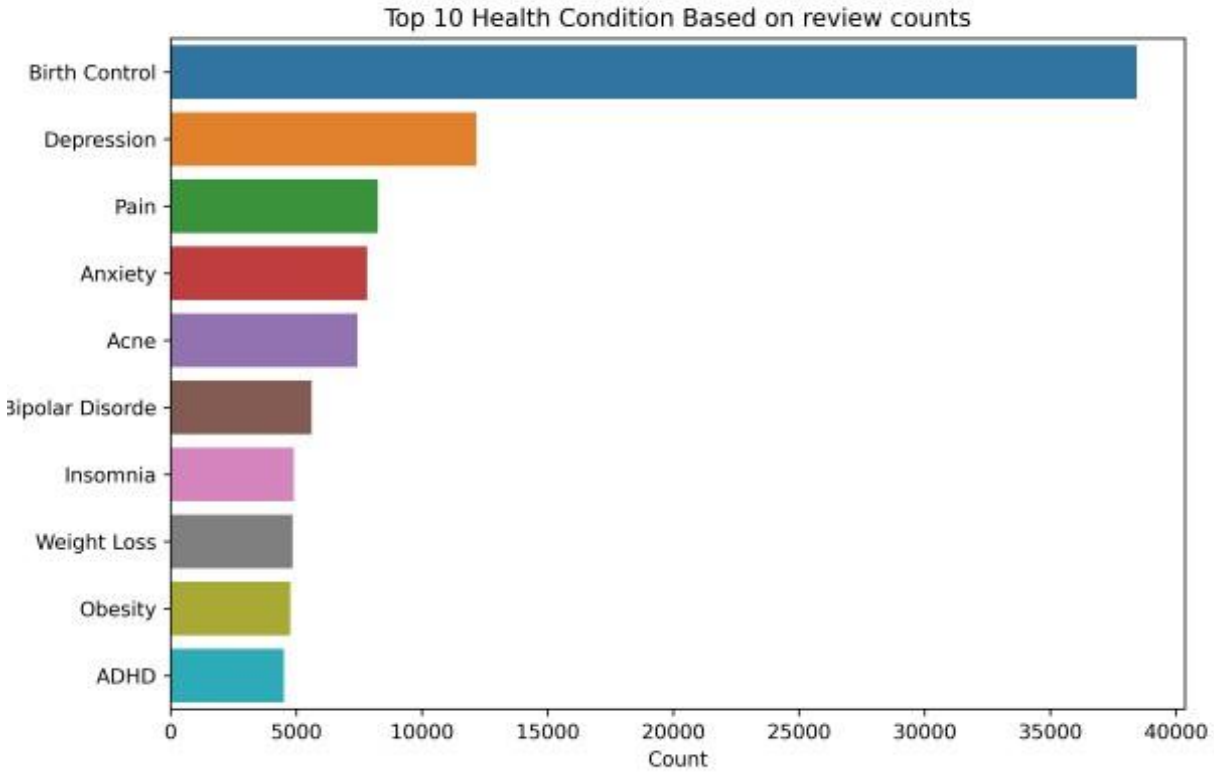
Data Understanding

- Dataset comes from UCI.edu website

  https://archive.ics.uci.edu/dataset/462/drug+review+dataset+drugs+com
- Dataset has 215K rows, 6 columns
- Dropped 1194 rows for missingness, clean dataset.
- Columns: ID, drug name, condition, review, rating, date, useful count.

EDA


WordCloud from Reviews with Positive Rating
nightmare
week
work
littleurine
month
pregnancy
role
duration
condemn
fruit
whatif
comforter
antdepressant
breakup
funeral
key
mark
give
wd
objection
hematoma
aggression
vertabra
waffle
praise
migrain
outlet
protien
condom
cling
lance
dwindle
abortive
lymph
prep
content
spark
relaxant
reocurrence
salofalk
shift
poison
lighten
th


Top 10 Health Condition Based on review counts
Birth Control
Depression
Pain
Anxiety
Acne
Bipolar Disorde
Insomnia
Weight Loss
Obesity
ADHD
0
5000
10000
15000
20000
25000
30000
35000
40000
Count

Data Preprocessing Target & Metrics

Target : Column ‘rating’ (0 or 1)

X : Column ‘review’(text data with 1-15 lines)

Metrics : Accuracy & F1 score(Balanced dataset)

Steps:

- Encoded Target as 0 for ratings (1-5) and 1 for ratings(6-10).
- Using class Text Preprocessor for cleaning X column ‘review’ .
  - ➢ Lowercasing, Removing stop words, punctuations, special signs.
  - ➢ Tokenization, pos tagging, lemmatize or stemming.
  - ➢ Tfidf Vectorizer or Count Vectorizer

Models (Baseline, Randomized Search CV)

Baseline :

Random Forest:
(Test Results)

Accuracy : 65.51

F1 Score : 65.01

Precision : 64.08

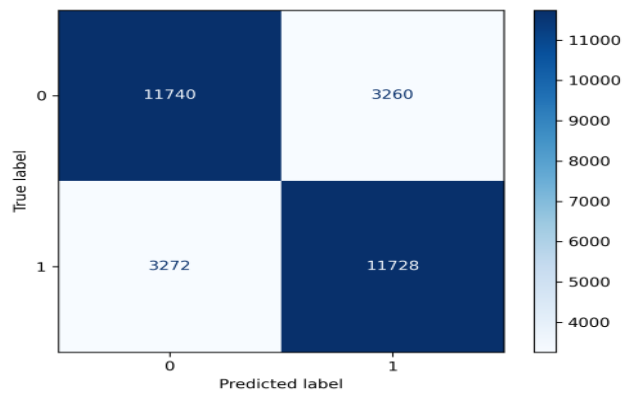
Recall : 65.98

Randomized Search CV (Test Results)

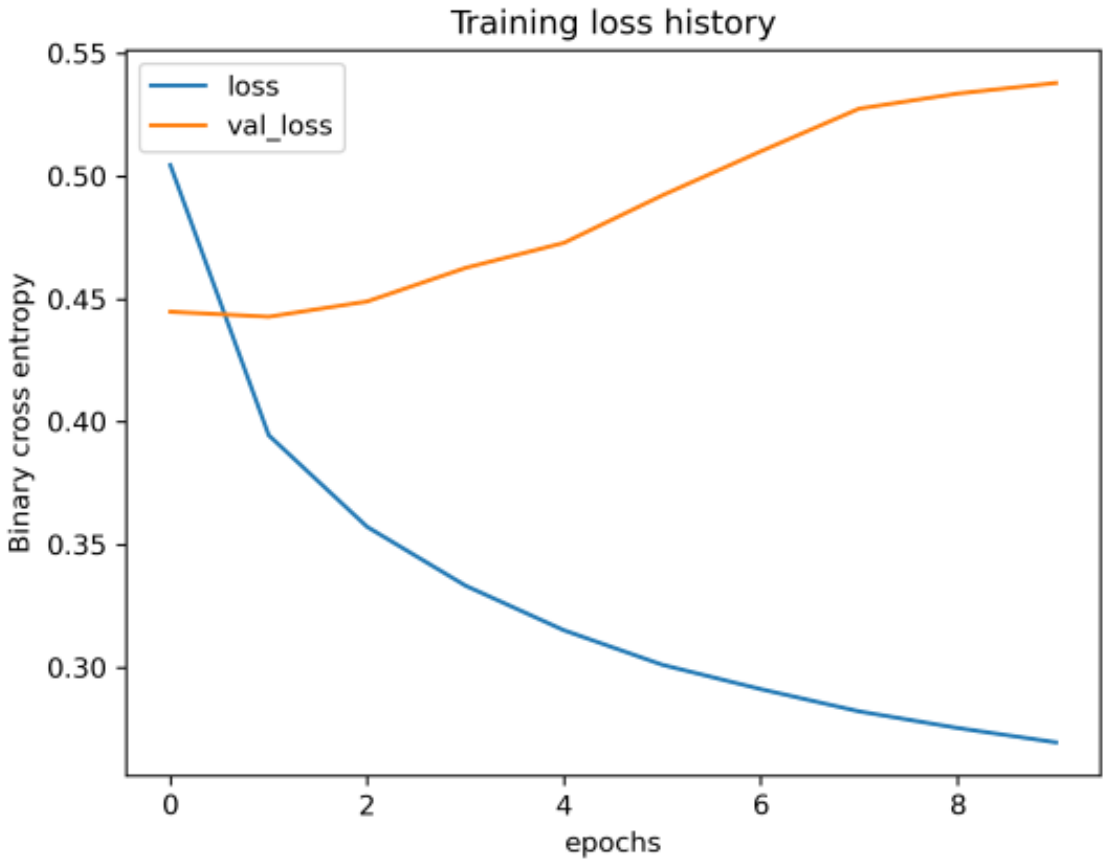
Model	Accuracy	F1 Score	Precision	Recall
Naïve Bayes	66.17	67.14	65.27	69.12
X G Boost	71.52	71.28	71.90	70.67
Random Forest	76.27	76.09	76.67	75.52

Tensor Flow

Sequential model, Binary cross entropy, applying Regularization, epochs =10
Test Results:
Accuracy: 78.22




```
# defining model & hidden layers
reg = l2(3e-3)
n_features = (28675, )
tensor_med_model = Sequential()
tensor_med_model.add(Dense(32, activation='tanh', input_shape = (n_features)))
tensor_med_model.add(Dense(16, activation='tanh', kernel_regularizer = reg))
tensor_med_model.add(Dense(12, activation='tanh', kernel_regularizer = reg))
tensor_med_model.add(Dense(8, activation='tanh', kernel_regularizer = reg))
tensor_med_model.add(Dense(1, activation = 'sigmoid'))
```



Stacking

- **X G Boost** – Used best model got from Randomized Search CV
- **Naïve Bayes** – Simplicity, efficient, work well with text data, cost efficiency.
- **Random Forest** – Used best model from Randomized Search CV.

Meta Model: Logistic Regression

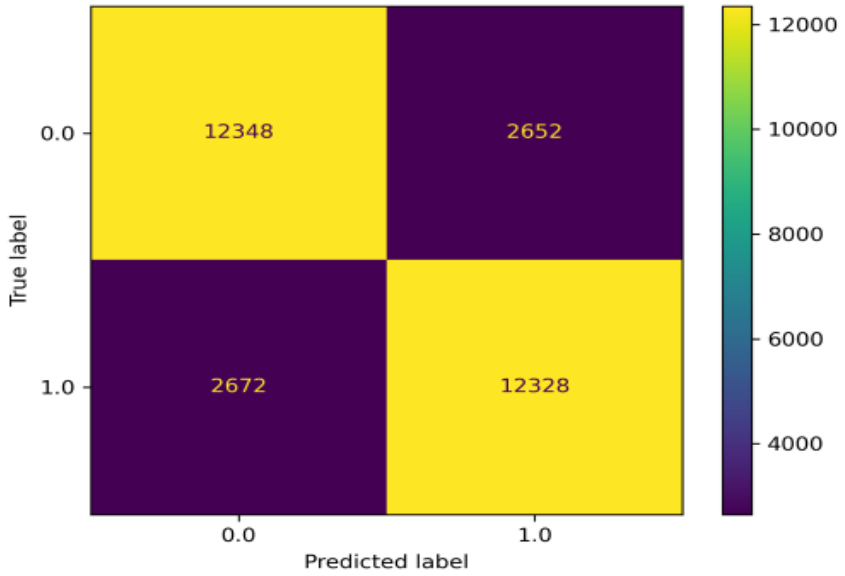
Stacking (Best Model) Test Results:

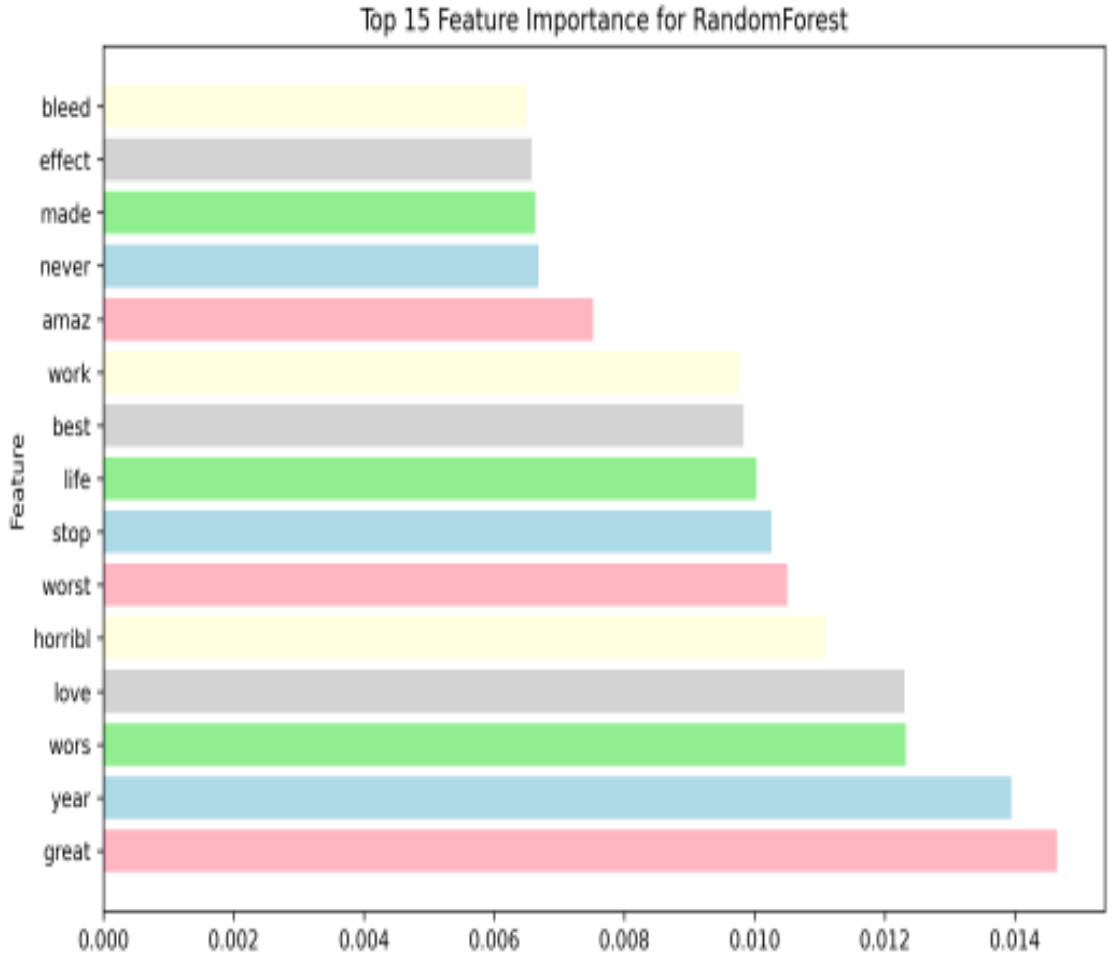
Accuracy	82.25
F1 Score	82.24
Precision	82.18
Recall	82.29

Stacking Visualization:

False Positive : Patient has No effect or had side effects after medication was taken.

False Negative: Patient condition improved after medication was taken.





Model Results

Metrics used Accuracy and F1 score, Dataset is Balanced data.

Model	Accuracy	F1 Score
Naïve Bayes	66.17	67.14
X G Boost	71.52	71.28
Random Forest	76.27	76.09
Stacking	82.25	82.24

Topic Modeling NMF

Topic modeling is a statistical modeling technique used to identify latent topics or themes within a collection of documents.

Using Non-Negative Matrix factorization model, and choosing n-components as 3, derived words associated with three topics.

X ~ WH

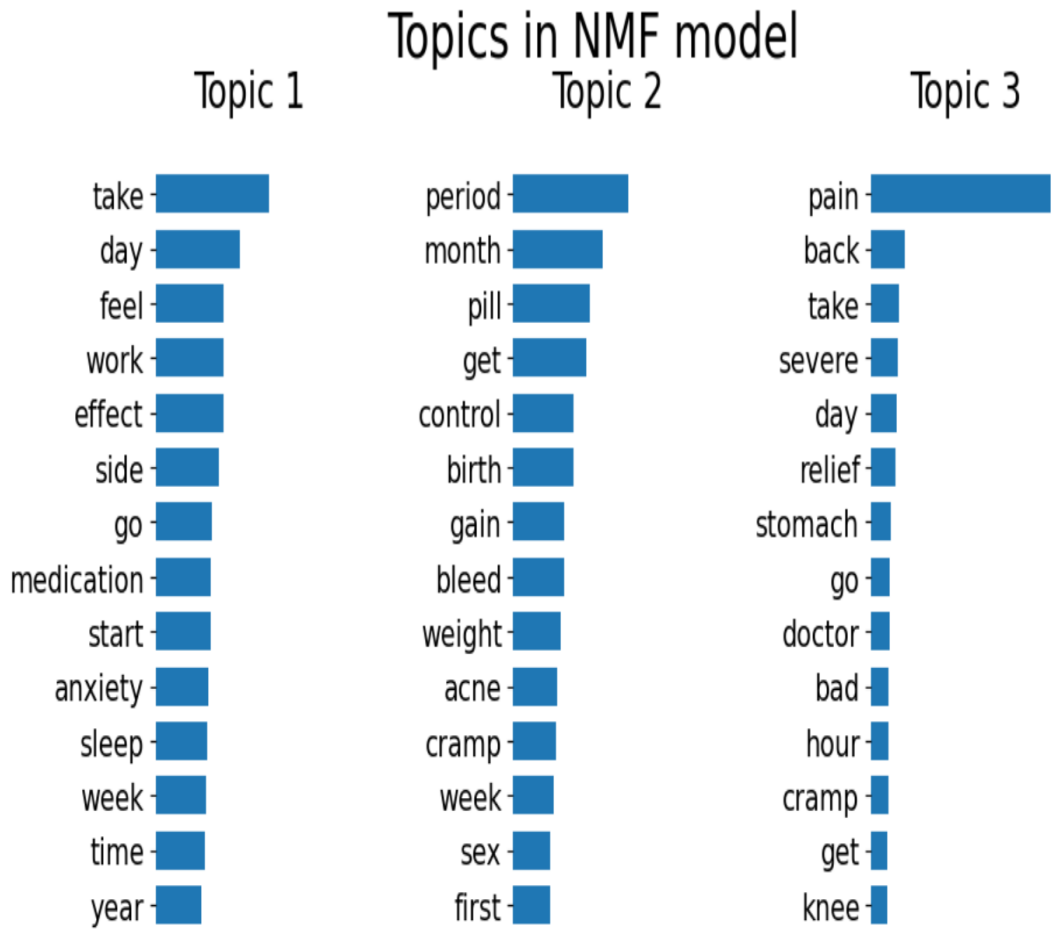
W – Importance of each token in fitted topics.

H – Weight of the fitted topic in each doc.

Topic 1 Label: Anxiety/Depression

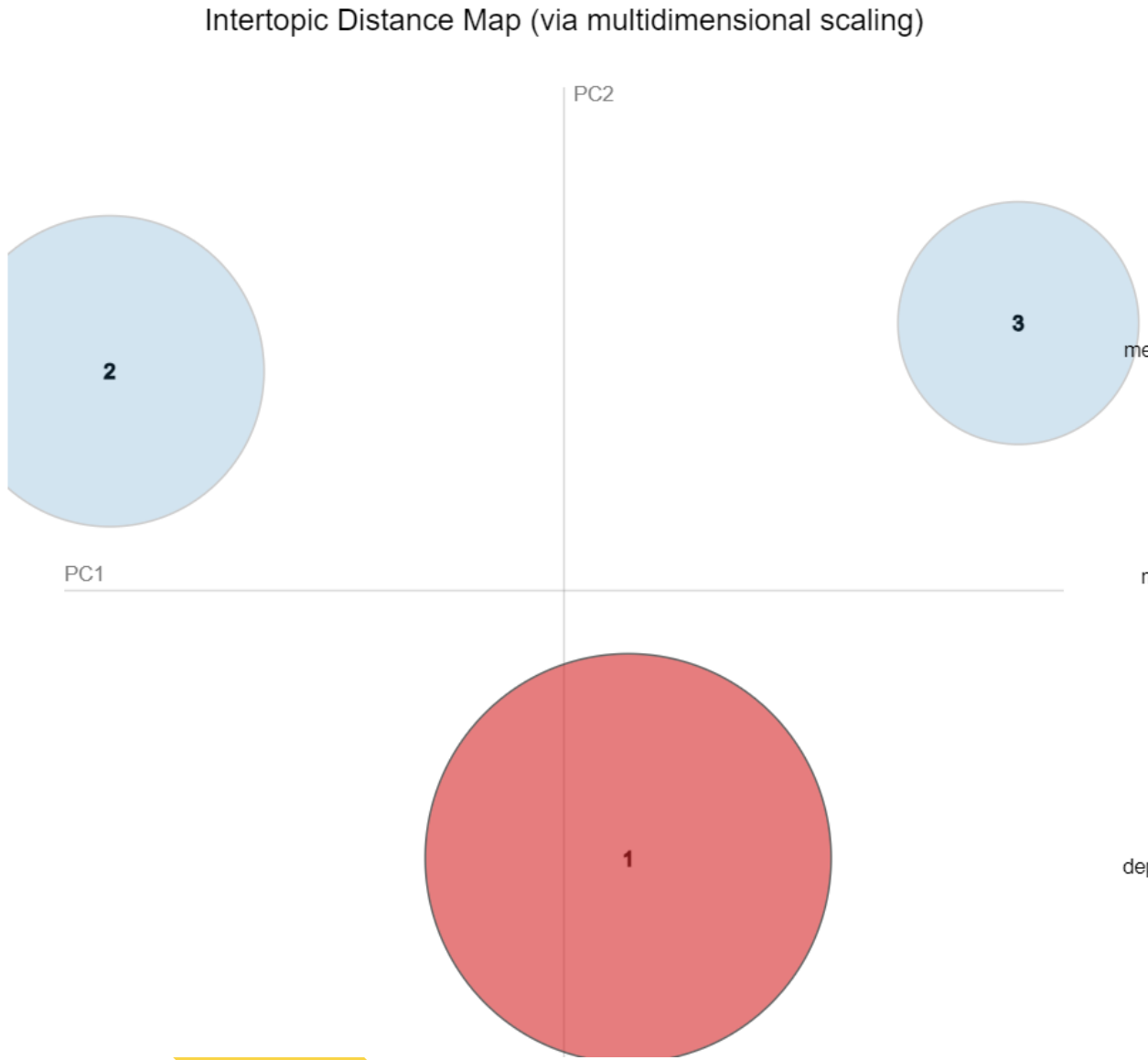
Topic 2 Label: Birth Control/Infertility

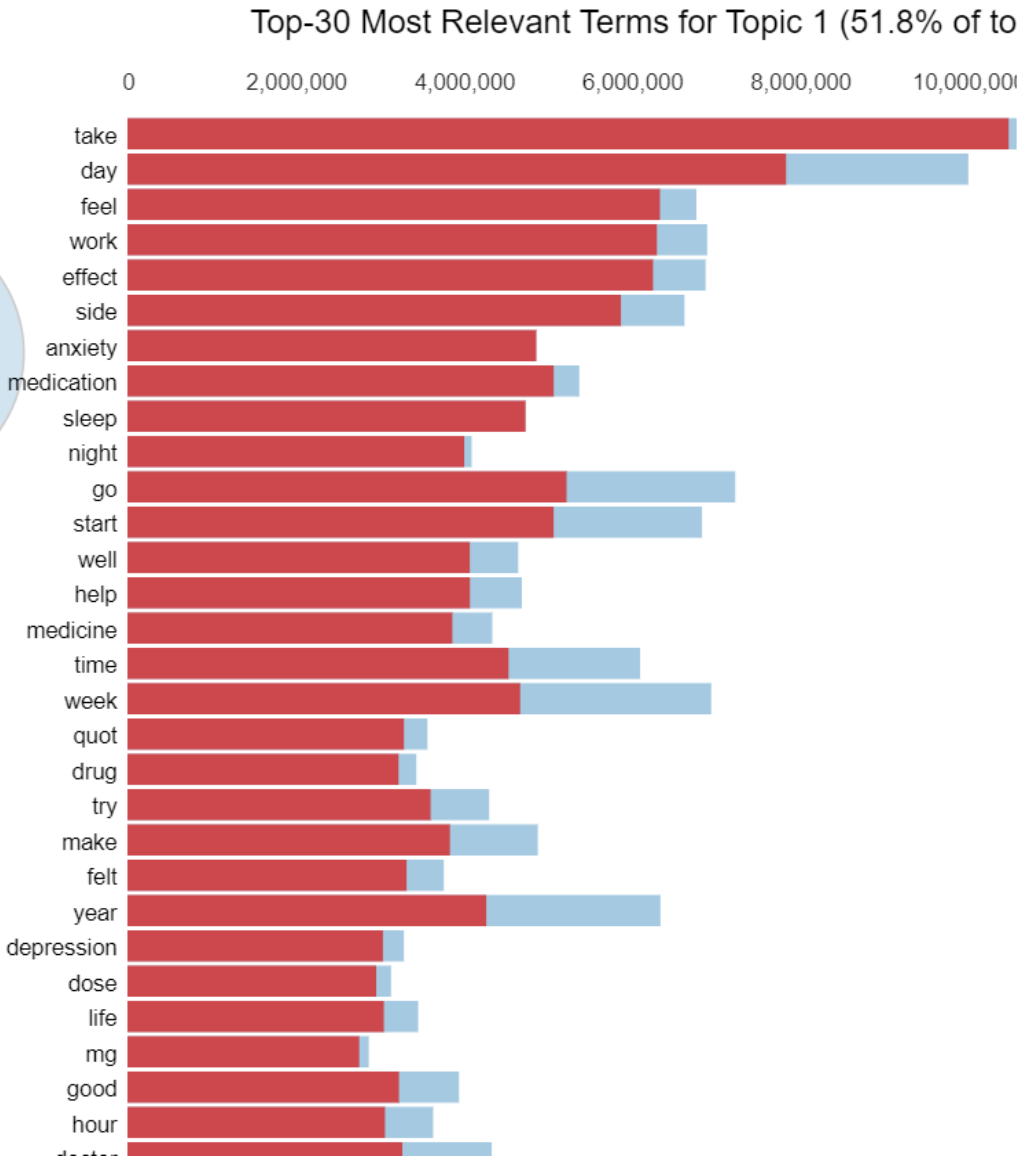
Topic 3 Label: Pain



NMF Visualization

Chrome HTML Document





Conclusion:

1. Best Model Stacking with best accuracy 82.25 to solve our Stakeholder's problem.
2. Topic Modeling helps to visualize health conditions as labels assuming as Birth Control, Anxiety & Pain.
3. Concentrate on True Negative & False Positive results, these patients needs immediate follow up to diagnose why Drug failed to work.

Next Steps:

- For Phase 2, use Word2Vec algorithm, widely used word representation technique.
- Implement TextBlob or PySpellCheck library to correct spelling mistakes for medical terms before running next model.

Thank you & Questions?

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