DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
ACHARYA INSTITUTE OF TECHNOLOGY
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Academic Project Presentation on

"Sequential Sentence Classification in Medical Abstracts"

Presented by: **Under the guidance of:**
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CHAPTER-1:
INTRODUCTORY SECTION

INTRODUCTION

Abstract

Mental illness, including depression, anxiety and bipolar disorder, accounts for a significant proportion of global disability and poses a substantial social, economic and heath burden. Treatment is presently dominated by pharmacotherapy, such as antidepressants, and psychotherapy, such as cognitive behavioural therapy; however, such treatments avert less than half of the disease burden, suggesting that additional strategies are needed to prevent and treat mental disorders. There are now consistent mechanistic, observational and interventional data to suggest diet quality may be a modifiable risk factor for mental illness. This review provides an overview of the nutritional psychiatry field. It includes a discussion of the neurobiological mechanisms likely modulated by diet, the use of dietary and nutraceutical interventions in mental disorders, and recommendations for further research. Potential biological pathways related to mental disorders include inflammation, oxidative stress, the gut microbiome, epigenetic modifications and neuroplasticity. Consistent epidemiological evidence, particularly for depression, suggests an association between measures of diet quality and mental health, across multiple populations and age groups; these do not appear to be explained by other demographic, lifestyle factors or reverse causality. Our recently published intervention trial provides preliminary clinical evidence that dietary interventions in clinically diagnosed populations are feasible and can provide significant clinical benefit. Furthermore, nutraceuticals including n-3 fatty acids, folate, S-adenosylmethionine, N-acetyl cysteine and probiotics, among others, are promising avenues for future research. Continued research is now required to investigate the efficacy of intervention studies in large cohorts and within clinically relevant populations, particularly in patients with schizophrenia, bipolar and anxiety disorders.

Abstract

Background: Diffuse low-grade gliomas (DLGGs) are heterogeneous tumors that inevitably differentiate into malignant entities, leading to disability and death. Recently, a shift toward up-front maximal safe resection of DLGGs has been favored. However, this transition is not supported by randomized controlled trial (RCT) data. Here, we sought to survey the neuro-oncology community on considerations for a surgical RCT for DLGGs.

Methods: A 21-question survey focusing on a surgical RCT for DLGGs was developed and validated by 2 neurosurgeons. A sample case of a patient for whom management might be debatable was presented to gather additional insight. The survey was disseminated to members of the Society for Neuro-Oncology (SNO) and responses were collected from March 16 to July 10, 2018.

Results: A total of 131 responses were collected. Sixty-three of 117 (54%) respondents thought an RCT would not be ethical, 39 of 117 (33%) would consider participating, and 56 of 117 (48%) believed an RCT would be valuable for determining the differing roles of biopsy, surgery, and observation. This was exemplified by an evenly distributed selection of the latter management options for our sample case. Eighty-three of 120 (69.2%) respondents did not believe in equipoise for DLGG patients. Quality of life and overall survival were deemed equally important end points for a putative RCT.

Conclusions: Based on our survey, it is evident that management of certain DLGG patients is not well defined and an RCT may be justified. As with any surgical RCT, logistic challenges are anticipated. Robust patient-relevant end points and standardization of perioperative adjuncts are necessary if a surgical RCT is undertaken.

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LITERATURE SURVEY

LITERATURE SURVEY

S.N	PAPER TITLE	AUTHORS	TECHNICAL IDEAS/ALGORITHMS	SHORTFALLS/DRAWBACKS
1.	PubMed 200k RCT: a Dataset for Sequential Sentence Classification in Medical Abstracts.	Franck Dernoncour and Ji Young Lee	200,000 abstracts of a randomized controlled trial	There is no new model architecture that is provided with the dataset for the classification of the dataset.

S.N	PAPER TITLE	AUTHORS	TECHNICAL IDEAS/ALGORITHMS	SHORTFALLS/DRAWBACKS
2.	Sequential Short-Text Classification with Recurrent and Convolutional Neural Networks.	Ji Young Lee, Franck Dernoncourt	Present a model based on RNN and CNN that incorporate the preceding short texts. With this idea, they achieved state-of-art results on three different datasets for dialog act prediction.	They leverage the preceding short text while classifying a subsequent one. But they do not consider finding complex meanings in the text and the the situation of the text or a sentence in the whole paragraph. The proposed system utilizes this method and builds on top of this to make the sentence classification more accurate and precise, having the meaning of the context for every sentence classified.

S.N	PAPER TITLE	AUTHORS	TECHNICAL IDEAS/ALGORITHMS	SHORTFALLS/DRAWBACKS
3.	Universal Sentence Encoder.	Daniel Cera, Yinfei Yanga, Sheng-yi Konga, Nan Huaa, Nicole Limtiacob, Rhomni St. Johna, Noah Constanta, Mario Guajardo-Ce spedes, Steve Yuanc, Chris Tara, Yun-Hsuan Sunga, Brian Stropea, Ray Kurzweila	Presents a model for encoding sentences into embedding vectors that specifically target transfer learning to other NLP tasks. Finds that transfer learning using sentence embeddings tends to outperform word-level transfer. Helps to get better results with a minimum amount of training data.	The transfer learning method that provides the in-depth learning of a model with a large dataset is utilized in the solution presented. But this alone does not help the desired result of classifying the medical abstracts efficiently. The proposed system implements character embedding, word embedding, and also positional embedding, which are not addressed in the paper.

S.N	PAPER TITLE	AUTHORS	TECHNICAL IDEAS/ALGORITHMS	SHORTFALLS/DRAWBACKS
4.	Character-based Neural Embeddings for Tweet Clustering.	Svitlana Vakulenko, Lyndon Nixon, Mihai Lupu.	The proposed approach overcomes the limitations related to the vocabulary explosion in the word-based models and allows for the seamless processing of multilingual content. Utilizing this method, complex words and relations between the words in a sentence can be understood better.	This helps in analyzing non-encountered words but still is not enough for accurate sentence classification. The proposed system utilizes the combination of character embedding with the token(word) embedding for getting better results. Along with these, it also makes use of positional embedding specific to Medical abstracts.

S.N	PAPER TITLE	AUTHORS	TECHNICAL IDEAS/ALGORITHMS	SHORTFALLS/DRAWBACKS
5.	Neural Networks for Joint Sentence Classification in Medical Paper Abstracts.	Franck Dernoncourt, Peter Szolovits	Combines the strength of Structured predictions.

This utilizes a popular technique of Glove Embedding. | In addition structure, the proposed solution makes use of all the techniques to get a combined deep learning model architecture that not only learns patterns of characters and words, but also the structure and the context with feature engineered analysis and fine-tuned parameters for the models. |

REQUIREMENT ANALYSIS FOR PROJECT IMPLEMENTATION

FUNCTIONAL REQUIREMENTS

- Effectively preprocess the data to fit in the model.

- To implement the Deep Neural Network Architectures.

- Learn the process and factors affecting the learning of the algorithm.

- Learn the patterns in the data.

- Feature Engineering the model with the knowledge gained from the data.

NON-FUNCTIONAL REQUIREMENTS

- Performance

- Reliability

- Accuracy

SOFTWARE REQUIREMENTS

- Browser: Google chrome or any other browser.

- Tensorflow,Keras

- Google Colab

- Tensorflow Hub

HARDWARE REQUIREMENTS

Minimum Requirements

- CPU: Intel i3 – 4030U @ 1.9GHz

- RAM: 8GB

- Google Colab

Recommended Requirements

- CPU: Intel i5 processor or above

- RAM: 16GB

- GPU for training

PROPOSED METHODOLOGY

PROPOSED METHODOLOGY

- **Dataset:**
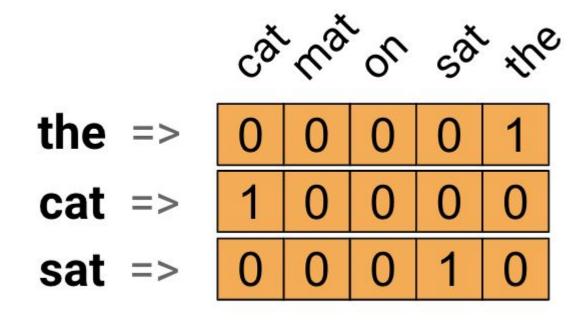
```
PubMed_200k_RCT
PubMed_200k_RCT_numbers_replaced_with_at_sign
PubMed_20k_RCT
PubMed_20k_RCT_numbers_replaced_with_at_sign
```
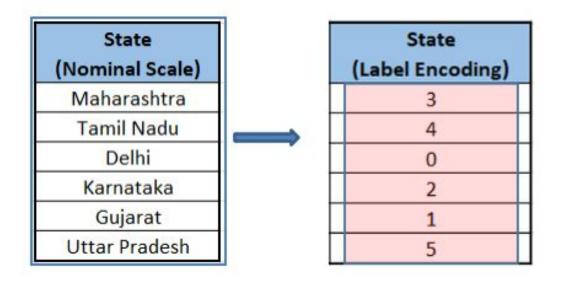
- `train.txt` - training samples.
- `dev.txt` - dev is short for development set, which is another name for validation set.
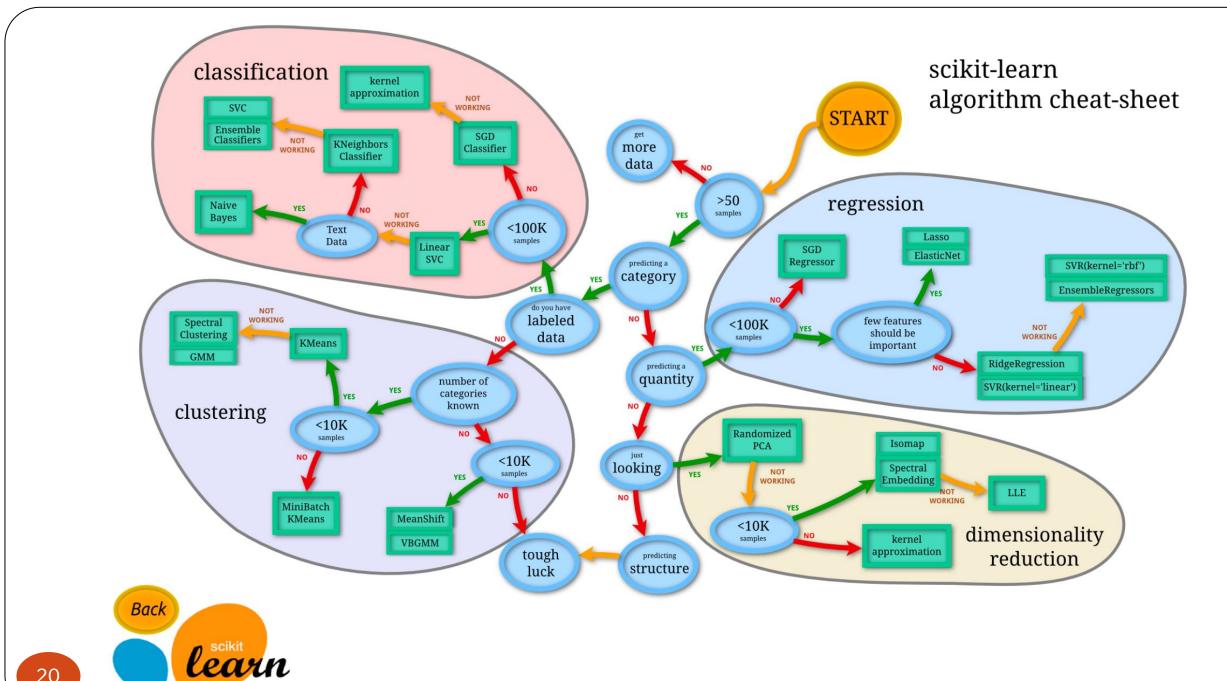- `test.txt` - test samples.

- **Sample Data:**

['###24293578\n',
 'OBJECTIVE\tTo investigate the efficacy of @ weeks of daily low-dose oral prednisolone in improving pain , mobility , and systemic low-grade inflammation in the short term and whether the effect would be sustained at @ weeks in older adults with moderate to severe knee osteoarthritis (OA) .\n',
 'METHODS\tA total of @ patients with primary knee OA were randomized @:@ ; @ received @ mg/day of prednisolone and @ received placebo for @ weeks .\n',
 'METHODS\tOutcome measures included pain reduction and improvement in function scores and systemic inflammation markers .\n',
 'METHODS\tPain was assessed using the visual analog pain scale (@-@ mm) .\n',
 'METHODS\tSecondary outcome measures included the Western Ontario and McMaster Universities Osteoarthritis Index scores , patient global assessment (PGA) of the severity of knee OA , and @-min walk distance (@MWD) .\n',
 'METHODS\tSerum levels of interleukin @ (IL-@) , IL-@ , tumor necrosis factor (TNF) - , and high-sensitivity C-reactive protein (hsCRP) were measured .\n',
 'RESULTS\tThere was a clinically relevant reduction in the intervention group compared to the placebo group for knee pain , physical function , PGA , and @MWD at @ weeks .\n',
 'RESULTS\tThe mean difference between treatment arms (@ % CI) was @ (@-@ @) , p < @ ; @ (@-@ @) , p < @ ; @ (@-@ @) , p < @ ; and @ (@-@ @) , p < @ , respectively .\n',
 'RESULTS\tFurther , there was a clinically relevant reduction in the serum levels of IL-@ , IL-@ , TNF - , and hsCRP at @ weeks in the intervention group when compared to the placebo group .\n',
 'RESULTS\tThese differences remained significant at @ weeks .\n',
 'RESULTS\tThe Outcome Measures in Rheumatology Clinical Trials-Osteoarthritis Research Society International responder rate was @ % in the intervention group and @ % in the placebo group (p < @) .\n',
 'CONCLUSIONS\tLow-dose oral prednisolone had both a short-term and a longer sustained effect resulting in less knee pain , better physical function , and attenuation of systemic inflammation in older patients with knee OA (ClinicalTrials.gov identifier NCT@) .\n',
 '\n',
 '###24854809\n',
 'BACKGROUND\tEmotional eating is associated with overeating and the development of obesity .\n',
 'BACKGROUND\tYet , empirical evidence for individual (trait) differences in emotional eating and cognitive mechanisms that contribute to eating during sad mood remain equivocal .\n',
 'OBJECTIVE\tThe aim of this study was to test if attention bias for food moderates the effect of self-reported emotional eating during sad mood (vs neutral mood) on actual food intake .\n',
```
[{'line_number': 0,
    'target': 'OBJECTIVE',
    'text': 'to investigate the efficacy of @ weeks of daily low-dose oral prednisolone in improving pain , mobility , and systemic
    'total_lines': 11},
    ...]
```
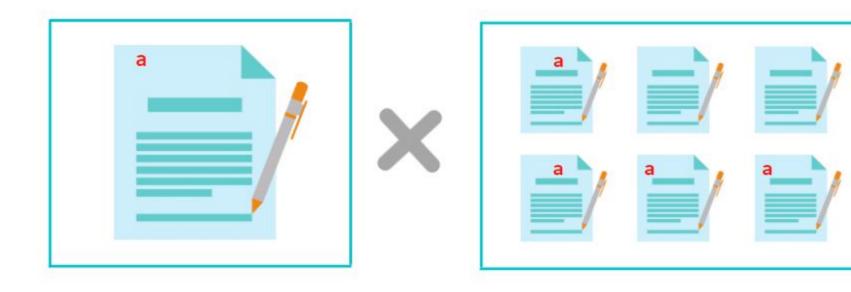
One-hot encoding

the => | 0 | 0 | 0 | 0 | 1 |

cat => | 1 | 0 | 0 | 0 | 0 |

sat => | 0 | 0 | 0 | 1 | 0 |

(columns: cat, mat, on, sat, the)

State (Nominal Scale)
Maharashtra
Tamil Nadu
Delhi
Karnataka
Gujarat
Uttar Pradesh

State (Label Encoding)
3
4
0
2
1
5

```
array(['BACKGROUND', 'CONCLUSIONS', 'METHODS', 'OBJECTIVE', 'RESULTS'],
    dtype=object))
```

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scikit-learn algorithm cheat-sheet

TF

IDF

×

Frequency of a word within the document

Frequency of a word across the documents

Naive Bayes
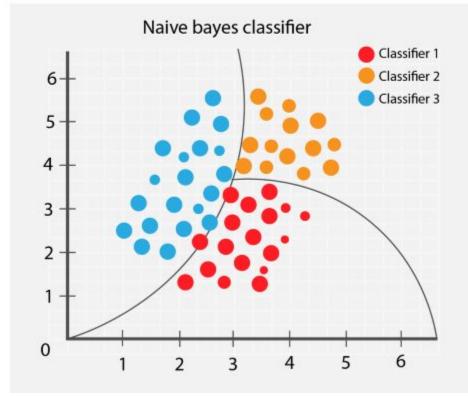
In machine learning, naive Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong (naive) independence assumptions between the features.
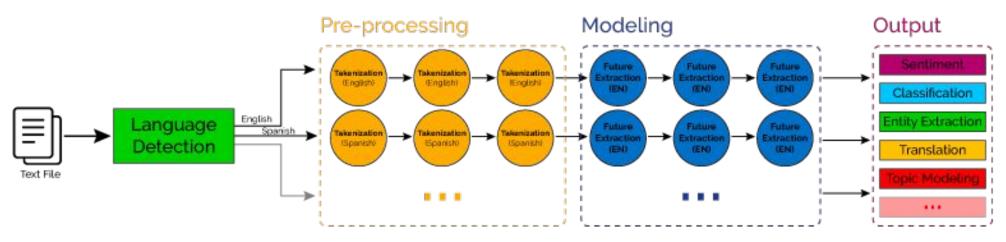
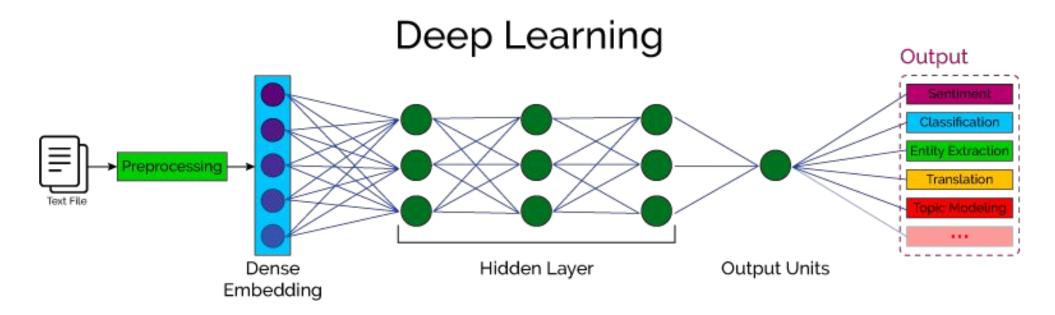$$P(A|B) = \frac{P(B|A)\ P(A)}{P(B)}$$

using Bayesian probability terminology, the above equation can be written as
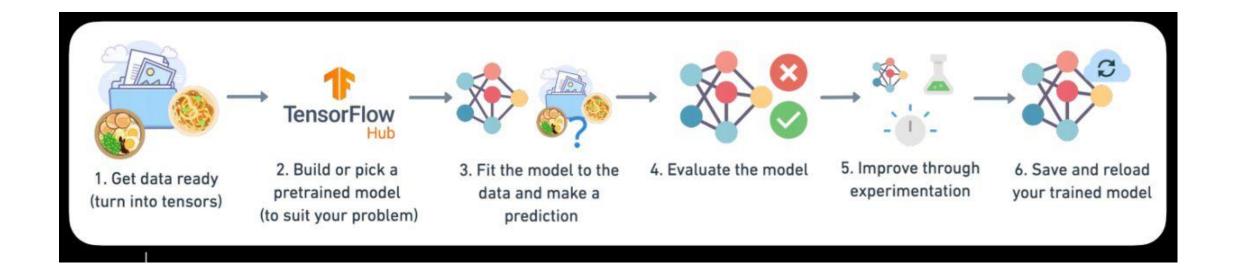
$$\text{Posterior} = \frac{\text{prior} \times \text{likelihood}}{\text{evidence}}$$

Naive bayes classifier

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DEEP LEARNING IMPLEMENTATION

Classical NLP

Pre-processing · Modeling · Output

Deep Learning
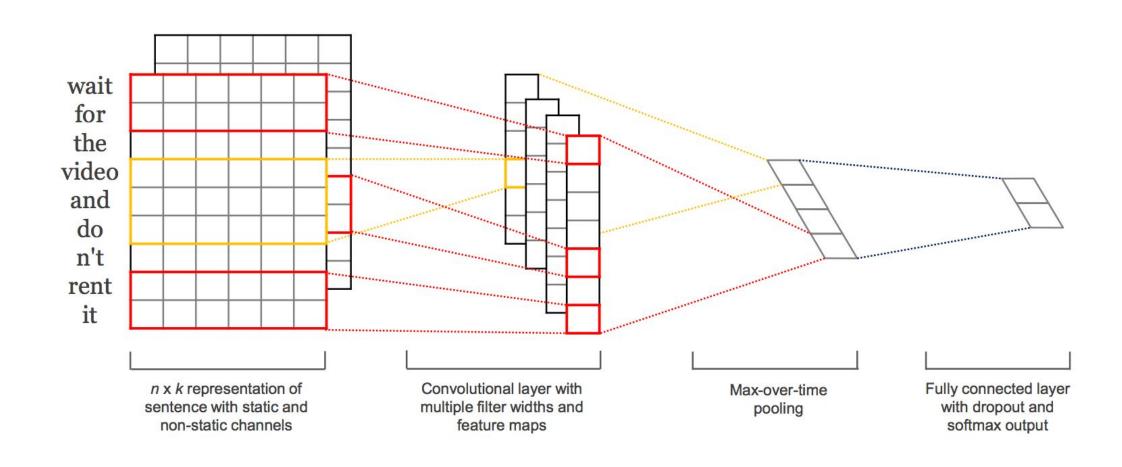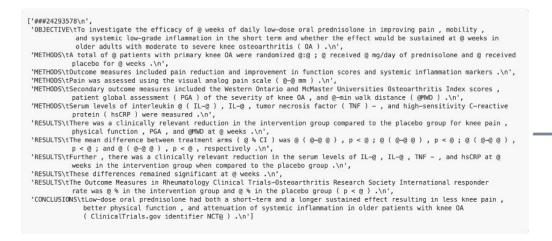
Steps in Modelling with TensorFlow

Conv1D with Token Embedding

wait
for
the
video
and
do
n't
rent
it

$n \times k$ representation of sentence with static and non-static channels

Convolutional layer with multiple filter widths and feature maps

Max-over-time pooling

Fully connected layer with dropout and softmax output
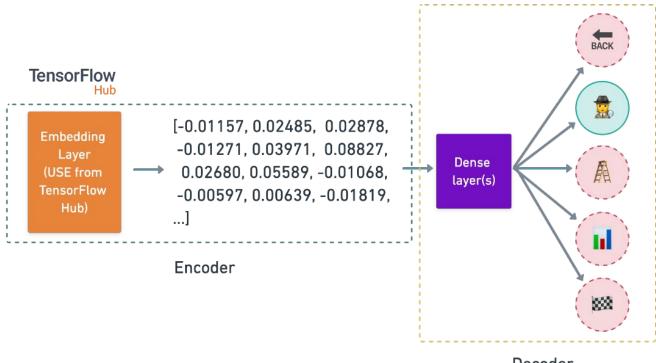
Feature extraction with pre-trained token embeddings

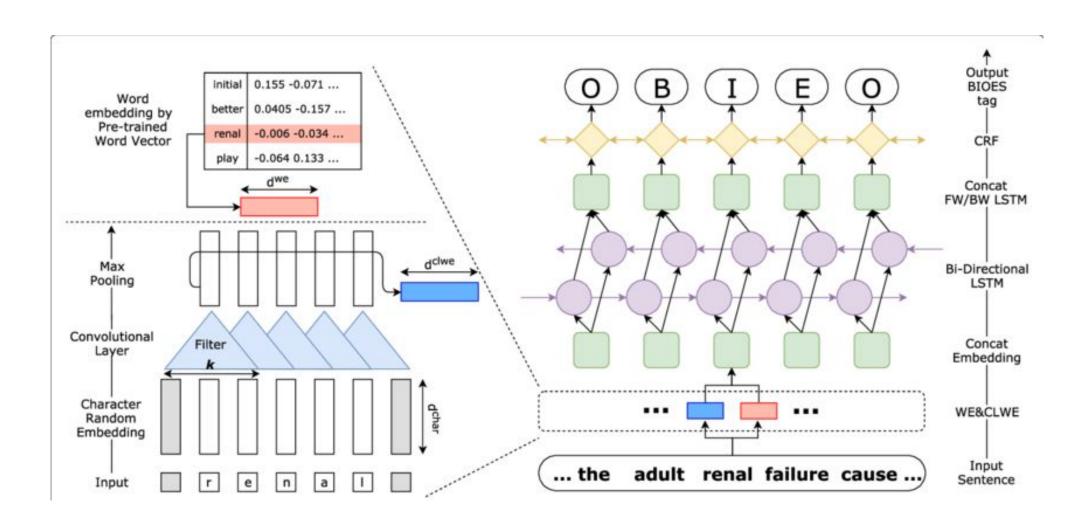# Token vs Character-level Embedding

[I, love, TensorFlow] →

```
[[0.492, 0.005, 0.019],    Each token
 [0.060, 0.233, 0.899],    gets turned
 [0.741, 0.983, 0.567],    into a feature
 ...,                      vector
```
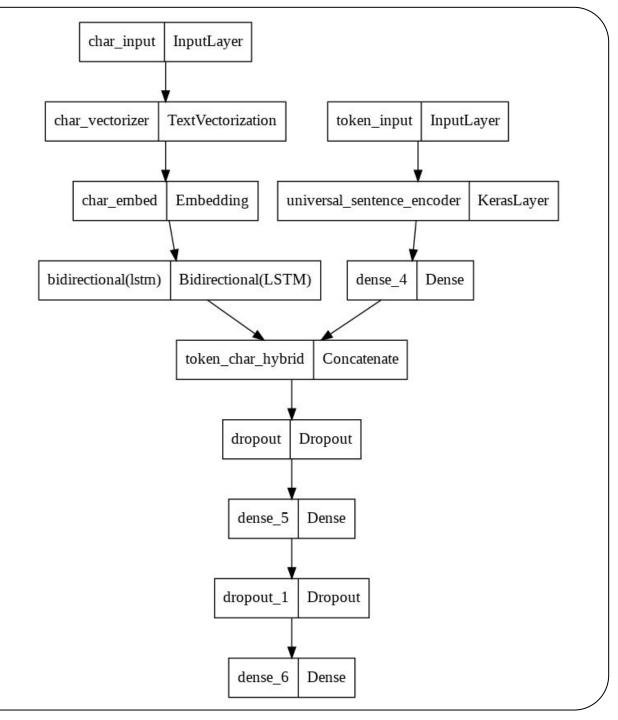
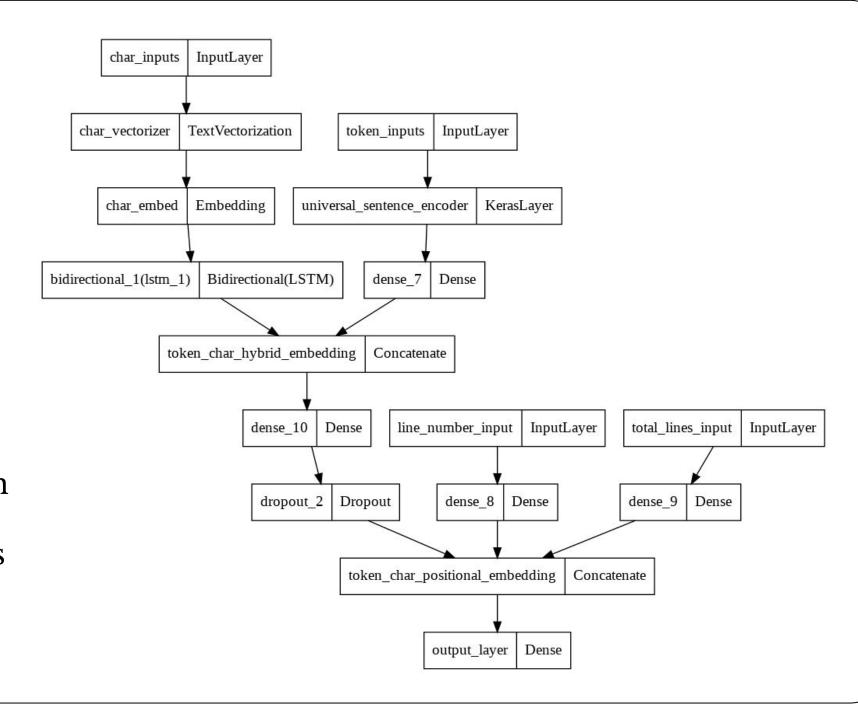[I, , l, o, v, e, , T, e, n, s, o, r, F, l, o, w]

```
[[0.692, 0.235, 0.088],    Each character
 [0.009, 0.956, 0.343],    gets turned
 [0.122, 0.454, 0.596],    into a feature
 ...,                      vector
```

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Conv1D with character embeddings

Combining pretrained token embeddings + character embeddings (hybrid embedding layer)

Transfer Learning with pre-trained token embeddings + character embeddings + positional embeddings
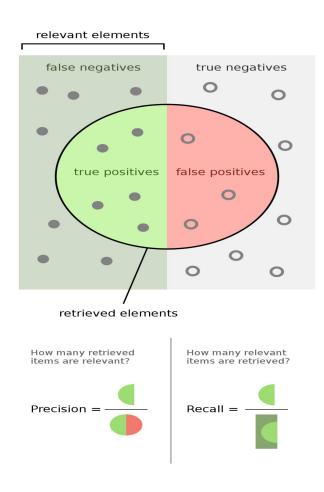
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TESTING

1. Recall (true positive rate)

Ratio between the numbers of Positive samples correctly classified to the total number of Positive samples

$$Recall = \frac{TP}{TP + FN}$$

2. Precision

Calculated by dividing the true positives by anything

that was predicted as a positive.

$$Precision = \frac{TP}{TP + FP}$$

relevant elements

false negatives   true negatives

true positives   false positives

retrieved elements

How many retrieved items are relevant?   How many relevant items are retrieved?

Precision =   Recall =

3. Accuracy

It is able to measure the true amount or concentration of a substance in a sample.

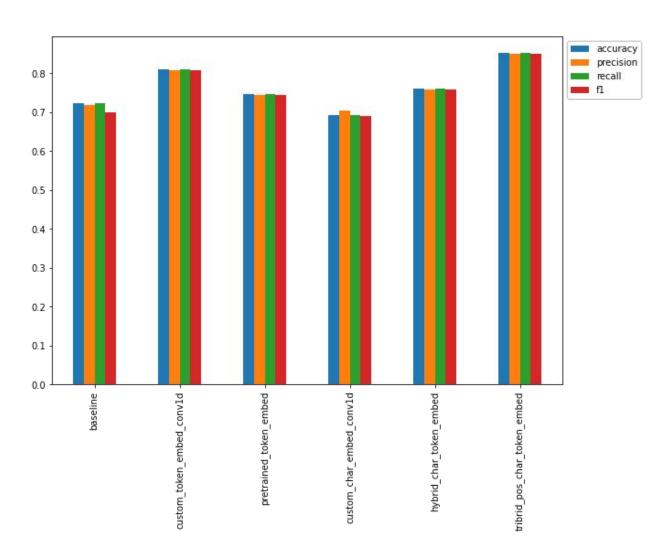$$\text{Accuracy} = \frac{TP + TN}{TP + FP + FN + TN}$$

4. F1 score

This is used to express the performance of the model high F1-score indicates a high value for both recall and precision. It have combined information about recall & precision

$$F_1 = 2 \cdot \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}} = \frac{TP}{TP + \frac{1}{2}(FP + FN)}$$

Comparison of the Models

Before and After Results

Nutritional psychiatry: the present state of the evidence

Wolfgang Marx [1], Genevieve Moseley [2], Michael Berk [2], Felice Jacka [2]

Affiliations + expand

PMID: 28942748   DOI: 10.1017/S0029665117002026

Abstract

Mental illness, including depression, anxiety and bipolar disorder, accounts for a significant proportion of global disability and poses a substantial social, economic and heath burden. Treatment is presently dominated by pharmacotherapy, such as antidepressants, and psychotherapy, such as cognitive behavioural therapy; however, such treatments avert less than half of the disease burden, suggesting that additional strategies are needed to prevent and treat mental disorders. There are now consistent mechanistic, observational and interventional data to suggest diet quality may be a modifiable risk factor for mental illness. This review provides an overview of the nutritional psychiatry field. It includes a discussion of the neurobiological mechanisms likely modulated by diet, the use of dietary and nutraceutical interventions in mental disorders, and recommendations for further research. Potential biological pathways related to mental disorders include inflammation, oxidative stress, the gut microbiome, epigenetic modifications and neuroplasticity. Consistent epidemiological evidence, particularly for depression, suggests an association between measures of diet quality and mental health, across multiple populations and age groups; these do not appear to be explained by other demographic, lifestyle factors or reverse causality. Our recently published intervention trial provides preliminary clinical evidence that dietary interventions in clinically diagnosed populations are feasible and can provide significant clinical benefit. Furthermore, nutraceuticals including n-3 fatty acids, folate, S-adenosylmethionine, N-acetyl cysteine and probiotics, among others, are promising avenues for future research. Continued research is now required to investigate the efficacy of intervention studies in large cohorts and within clinically relevant populations, particularly in patients with schizophrenia, bipolar and anxiety disorders.

Considerations for a surgical RCT for diffuse low-grade glioma: a survey

Alireza Mansouri [1], Karanbir Brar [2], Michael D Cusimano [3]

Affiliations + expand

PMID: 32537182   PMCID: PMC7274180 (available on 2021-06-01)   DOI: 10.1093/nop/npz058

Abstract

Background: Diffuse low-grade gliomas (DLGGs) are heterogeneous tumors that inevitably differentiate into malignant entities, leading to disability and death. Recently, a shift toward up-front maximal safe resection of DLGGs has been favored. However, this transition is not supported by randomized controlled trial (RCT) data. Here, we sought to survey the neuro-oncology community on considerations for a surgical RCT for DLGGs.

Methods: A 21-question survey focusing on a surgical RCT for DLGGs was developed and validated by 2 neurosurgeons. A sample case of a patient for whom management might be debatable was presented to gather additional insight. The survey was disseminated to members of the Society for Neuro-Oncology (SNO) and responses were collected from March 16 to July 10, 2018.

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Conclusions: Based on our survey, it is evident that management of certain DLGG patients is not well defined and an RCT may be justified. As with any surgical RCT, logistic challenges are anticipated. Robust patient-relevant end points and standardization of perioperative adjuncts are necessary if a surgical RCT is undertaken.

CONCLUSION & FUTURE SCOPE

6.1. CONCLUSION

- To get a quick brief about the Medical research paper.

- Save time of the medical professionals.

6.2. FUTURE SCOPE

- Find out the reasons for wrong predictions and implement the solution.

- Implement this to other kind of research papers.

- Deploy the model.

REFERENCES

- Source of data for training and validation: PubMed 200k RCT: a Dataset for Sequential Sentence Classification in Medical Abstracts
- Model architecture that gave the most accurate results: Neural networks for joint sentence classification in medical paper abstracts

THANK YOU