Bloom's Taxonomy

Aman (IMT 2018006)

Mentors :Praseedha ,Shyam

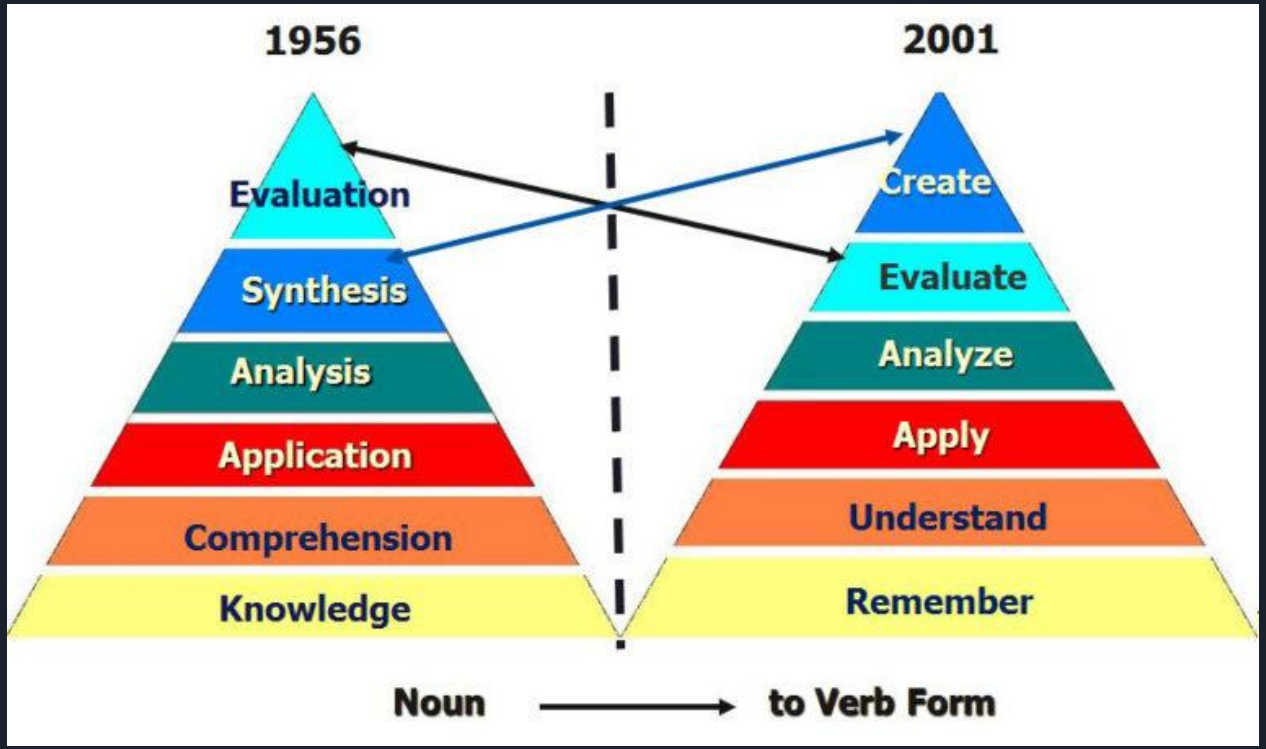
Overview

Bloom's Taxonomy comprises three learning domains: the cognitive, affective, and psychomotor, and assigns to each of these domains a hierarchy that corresponds to different levels of learning.

The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities.

Our focus is on cognitive domain.

Bloom's Taxonomy



LOW LEVEL THINKING SKILLS ◄——► HIGH LEVEL THINKING SKILLS

Knowledge

...thout ...eviously ...g facts, ...nswers.

Key words:

Choose, Copy, Define, Duplicate, Find, How, Identify, Label, List, Listen, Locate, Match, Memorise, Name, Observe, Omit, Quote, Read, Recall, Recite, Recognise, Record, Relate, Remember, Repeat, Reproduce, Retell, Select, Show, Spell, State, Tell, Trace, What, When, Where, Which, Who, Why, Write

Actions:

Describing, Finding, Identifying, Listing, Locating, Naming, Recognising, Retrieving

Outcomes:

Definition, Fact, Label, List, Quiz, Reproduction, Test, Workbook, Worksheet

Questions:

Can you list three ...?
Can you recall ...?
Can you select ...?
How did _____ happen?
How is ...?
How would you describe ...?
How would you explain ...?
How would you show ...?
What is ...?
When did ...?

Comprehension

To show understanding finding information from the text. Demonstrating basic understanding of facts and ideas.

Key words:

Ask, Cite, Classify, Compare, Contrast, Demonstrate, Discuss, Estimate, Explain, Express, Extend, Generalise, Give examples, Illustrate, illustrate, Indicate, Infer, Interpret, Match, Observe, Outline, Predict, Purpose, Relate, Rephrase, Report, Restate, Review, Show, Summarise, Translate

Actions:

Classifying, Comparing, Exemplifying, Explaining, Inferring, Interpreting, Paraphrasing, Summarising

Outcomes:

Collection, Examples, Explanation, Label, List, Outline, Quiz, Show and tell, Summary

Questions:

Can you explain what is happening . . . what is meant . . .?
How would you classify the type of ...?
How would you compare ...?contrast ...?
How would you rephrase the meaning ...?
How would you summarise ...?
What can you say about ...?
What facts or ideas show ...?
What is the main idea of ...?
Which is the best answer ...?

Application

To use in a new situation. Solving problems by applying acquired knowledge, facts, techniques and rules in a different way.

Key words:

Act, Administer, Apply, Associate, Build, Calculate, Categorise, Choose, Classify, Connect, Construct, Correlation, Demonstrate, Develop, Dramatise, Employ, Experiment with, Group, Identify, Illustrate, Interpret, Interview, Link, Make use of, Manipulate, Model, Organise, Perform, Plan, Practice, Relate, Represent, Select, Show, Simulate, Solve, Summarise, Teach, Transfer, Translate, Use

Actions:

Carrying out, Executing, Implementing, Using

Outcomes:

Demonstration, Diary, Illustrations, Interview, Journal, Performance, Presentation, Sculpture, Simulation

Questions:

How would you use...?
What examples can you find to ...?
How would you solve _____ using what you have learned ...?
How would you organise _____ to show ...?
How would you show your understanding of ...?
What approach would you use to...?
How would you apply what you learned to

Analysis

To examine in detail. Examining and breaking information into parts by identifying motives or causes; making inferences and finding evidence to support generalisations.

Key words:

Analyse, Appraise, Arrange, Assumption, Breakdown, Categorise, Cause and effect, Choose, Classify, Differences, Discover, Discriminate, Dissect, Distinction, Distinguish, Divide, Establish, Examine, Find, Focus, Function, Group, Highlight, In-depth discussion, Inference, Inspect, Investigate, Isolate, List, Motive, Omit, Order, Organise, Point out, Prioritize, Question, Rank, Reason, Relationships, Reorganise, Research, See, Select, Separate, Similar to, Simplify, Survey, Take part in, Test for, Theme, Comparing

Actions:

Attributing, Deconstructing, Integrating, Organising, Outlining, Structuring

Outcomes:

Abstract, Chart, Checklist, Database, Graph, Mobile, Report, Spread sheet, Survey

Questions:

What are the parts or features of ...?
How is _____ related to ...?
Why do you think ...?
What is the theme ...?
What motive is there ...?
Can you list the parts ...?
What inference can you make ...?
What conclusions can you draw ...?
How would you classify ...?
How would you categorise ...?

Synthesis

To change or create into something new. Compiling information together in a different way by combining elements in a new pattern or proposing alternative solutions.

Key words:

Adapt, Add to, Build, Change, Choose, Combine, Compile, Compose, Construct, Convert, Create, Delete, Design, Develop, Devise, Discover, Discuss, Elaborate, Estimate, Experiment, Extend, Formulate, Happen, Hypothesise, Imagine, Improve, Innovate, Integrate, Invent, Make up, Maximise, Minimise, Model, Modify, Original, Originate, Plan, Predict, Produce, Propose, Reframe, Revise, Rewrite, Simplify, Solve, Speculate, Substitute, Suppose, Tabulate, Test, Theorise, Think, Transform, Visualise

Actions:

Constructing, Designing, Devising, Inventing, Making, Planning, Producing

Outcomes:

Advertisement, Film, Media product, New game, Painting, Plan, Project, Song, Story

Questions:

What changes would you make to solve...?
How would you improve ...?
What would happen if...?
Can you elaborate on the reason...?
Can you propose an alternative...?
Can you invent...?
How would you adapt _____ to create a different...?
How could you change (modify) the plot (plan) ...?

Evaluation

To justify. Presenting and defending opinions by making judgements about information, validity of ideas or quality of work based on a set of criteria.

Key words:

Agree, Appraise, Argue, Assess, Award, Bad, Choose, Compare, Conclude, Consider, Convince, Criteria, Criticise, Debate, Decide, Deduct, Defend, Determine, Disprove, Dispute, Effective, Estimate, Evaluate, Explain, Give reasons, Good, Grade, How do we know?, Importance, Infer, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Persuade, Prioritise, Prove, Rate, Recommend, Rule on, Select, Support, Test, Useful, Validate, Value, Why

Actions:

Attributing, Checking, Deconstructing, Integrating, Organising, Outlining, Structuring

Outcomes:

Abstract, Chart, Checklist, Database, Graph, Mobile, Report, Spread sheet, Survey

Questions:

Do you agree with the actions/outcomes...?
What is your opinion of...?
How would you prove/disprove...?
Can you assess the value/importance of...?
Would it be better if...?
Why did they (the character) choose...?
What would you recommend...?
How would you rate the...?
What would you cite to defend the actions ...?

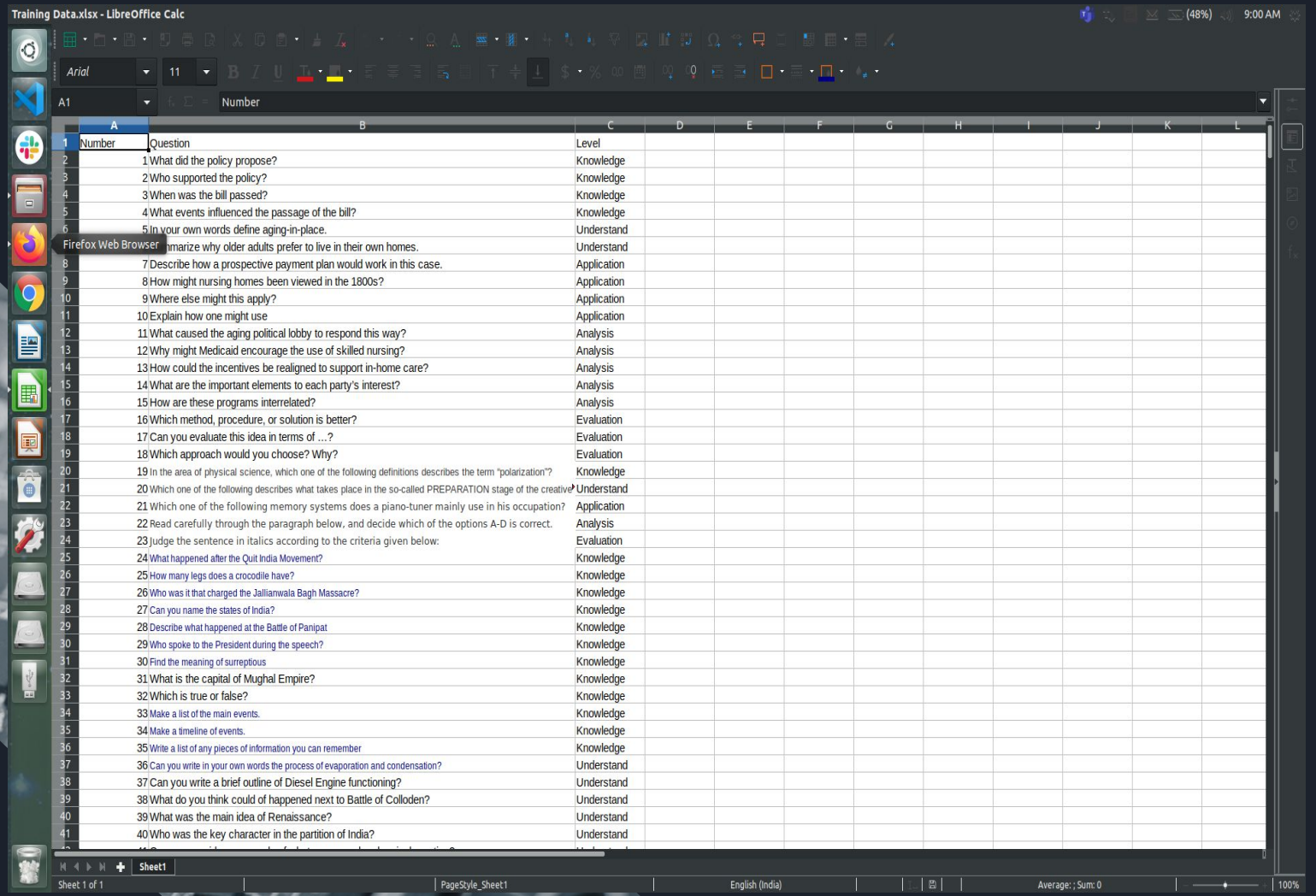
Understanding the problems

01 We have a dataset comprising of questions and labels.

02 We are using NLP techniques to do sentence classification.Using NLP models we need to predict the label for a sentence.

03 Presently we have a small dataset which is balanced.We need more data for training for better accuracy of the model.

Training Dataset



Number	Question	Level
1	What did the policy propose?	Knowledge
2	Who supported the policy?	Knowledge
3	When was the bill passed?	Knowledge
4	What events influenced the passage of the bill?	Knowledge
5	In your own words define aging-in-place.	Understand
6	marize why older adults prefer to live in their own homes.	Understand
7	Describe how a prospective payment plan would work in this case.	Application
8	How might nursing homes been viewed in the 1800s?	Application
9	Where else might this apply?	Application
10	Explain how one might use	Application
11	What caused the aging political lobby to respond this way?	Analysis
12	Why might Medicaid encourage the use of skilled nursing?	Analysis
13	How could the incentives be realigned to support in-home care?	Analysis
14	What are the important elements to each party's interest?	Analysis
15	How are these programs interrelated?	Analysis
16	Which method, procedure, or solution is better?	Evaluation
17	Can you evaluate this idea in terms of …?	Evaluation
18	Which approach would you choose? Why?	Evaluation
19	In the area of physical science, which one of the following definitions describes the term "polarization"?	Knowledge
20	Which one of the following describes what takes place in the so-called PREPARATION stage of the creative	Understand
21	Which one of the following memory systems does a piano-tuner mainly use in his occupation?	Application
22	Read carefully through the paragraph below, and decide which of the options A-D is correct.	Analysis
23	Judge the sentence in italics according to the criteria given below:	Evaluation
24	What happened after the Quit India Movement?	Knowledge
25	How many legs does a crocodile have?	Knowledge
26	Who was it that charged the Jallianwala Bagh Massacre?	Knowledge
27	Can you name the states of India?	Knowledge
28	Describe what happened at the Battle of Panipat	Knowledge
29	Who spoke to the President during the speech?	Knowledge
30	Find the meaning of surreptious	Knowledge
31	What is the capital of Mughal Empire?	Knowledge
32	Which is true or false?	Knowledge
33	Make a list of the main events.	Knowledge
34	Make a timeline of events.	Knowledge
35	Write a list of any pieces of information you can remember	Knowledge
36	Can you write in your own words the process of evaporation and condensation?	Understand
37	Can you write a brief outline of Diesel Engine functioning?	Understand
38	What do you think could of happened next to Battle of Colloden?	Understand
39	What was the main idea of Renaissance?	Understand
40	Who was the key character in the partition of India?	Understand

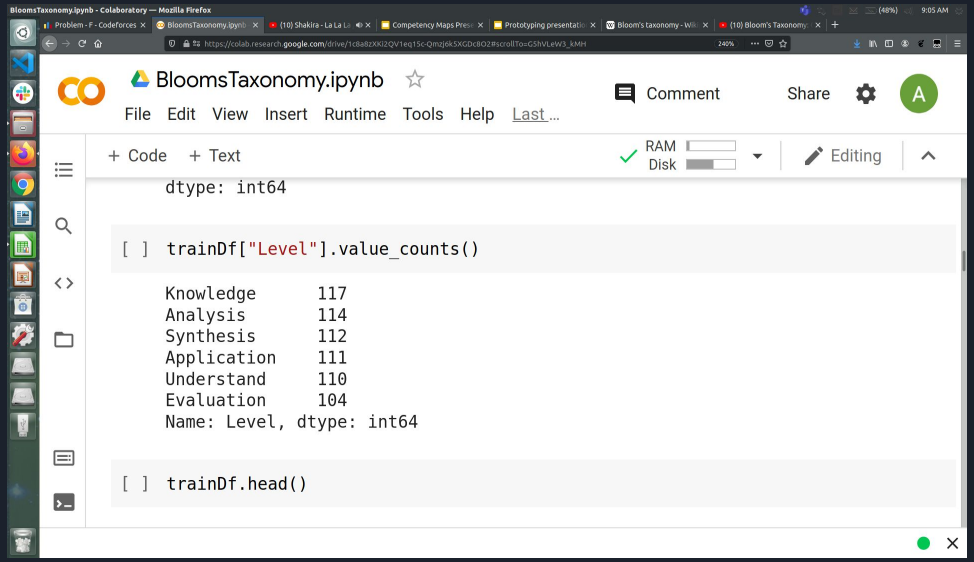
Training Data.xlsx - LibreOffice Calc

	A	B	C	D	E	F	G	H	I	J	K	L
446	445	Examine carefully the given map extract on the following page to help you work out the exercise	Analysis									
447	446	Inspect each of these Boolean expressions, and determine whether each one is a sum of produc	Analysis									
448	447	Inspect the size of the loaded data: how many objects and variables does the iris data matrix cor	Analysis									
449	448	Can you distinguish for me between what is reasonably achievable and what are exaggerations	Analysis									
450	449	Can you distinguish aged rums from unaged rums by smell	Analysis									
451	450	Can you distinguish pot still rums from column still rums by taste	Analysis									
452	451	Inspect the pattern of GPS positions relative to the “known” published value	Analysis									
453	452	How does your agency inspect against its expectation for operators	Analysis									
454	453	How to inspect and maintain fresh water plumbing systems properly	Analysis									
455	454	Can you analyze the fractures and determine which should be repaired surgically	Analysis									
456	455	Can you please analyze modern contemporary culture and tell me how your work plays a signific	Analysis									
457	456	How effectively did students analyze course content on race, class, and privilege through autobi	Analysis									
458	457	How do you analyze a marginally RCT	Analysis									
459	458	Contrast the treatment of "well known" trademarks provided by Paris Article and by TRIPS Article	Analysis									
460	459	Contrast the VallesMarineris on Mars with the Grand Canyon	Analysis									
461	460	How does Hawaii contrast and compare to Florida?	Analysis									
462	461	Investigate whether or not the systemcan be solved for x; y; z	Analysis									
463	462	Investigate (pointwise) convergence and absolute convergence of the given series of functions	Analysis									
464	463	How would you investigate this patient	Analysis									
465	464	How would you investigate this abnormality	Analysis									
466	465	What can I do to investigate this problem further	Analysis									
467	466	How the investigation was undertaken	Analysis									
468	467	How would you differentiate between heterodox and mainstream	Analysis									
469	468	How do I differentiate between "deceive" and "cheat on"?	Analysis									
470	469	Apply and integrate several different strategies to solve a mathematical problem (not according to	Synthesis									
471	470	Can you create new and unusual uses for . . .?	Synthesis									
472	471	Can you design a . . . to . . .?	Synthesis									
473	472	Can you develop a proposal which would . . .?	Synthesis									
474	473	Can you invent another character for the story?	Synthesis									
475	474	Can you see a possible solution to . . .?	Synthesis									
476	475	Can you write a new recipe for a tasty dish?	Synthesis									
477	476	Choose a character. Rewrite a scene from the story from this character's point of view.	Synthesis									
478	477	Combine any two sports to develop a new Olympic sport.	Synthesis									
479	478	Combine elements of drama, music, and dance into a stage presentation.	Synthesis									
480	479	Compose a class story.	Synthesis									
481	480	Compose a dialogue between Atticus Finch and Tom Robinson when they first met.	Synthesis									
482	481	Compose a rhythm or put new words to a known melody.	Synthesis									
483	482	Compose a simple rap or rhyme about zoo animals.	Synthesis									
484	483	Compose music for a frog play.	Synthesis									
485	484	Compose a complete C program that reads text strings from a text file into a suitable data	Synthesis									
486	485	Compose a device that would assist an athlete in their training.	Synthesis									

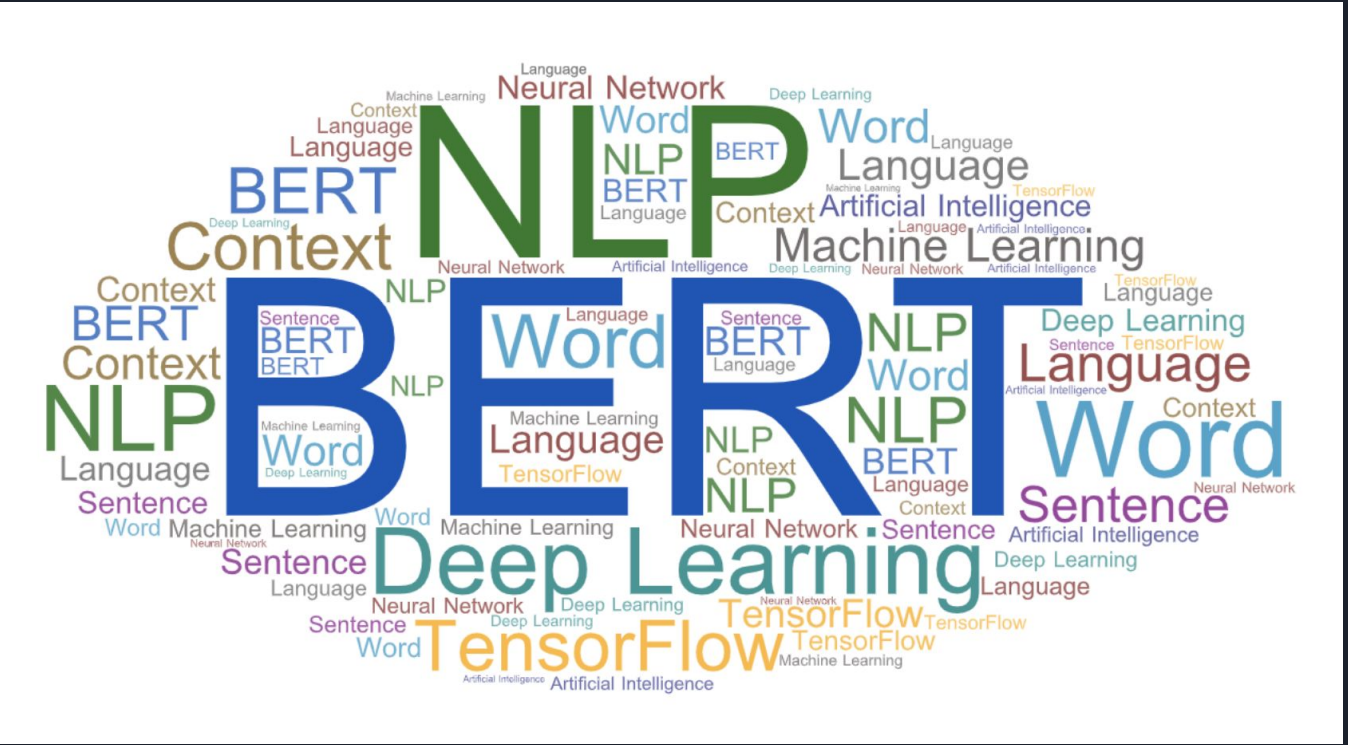
Sheet1

Sheet 1 of 1 | PageStyle_Sheet1 | English (India) | Average: ; Sum: 0 | 100%

Dataset composition



Our job is sentence classification.



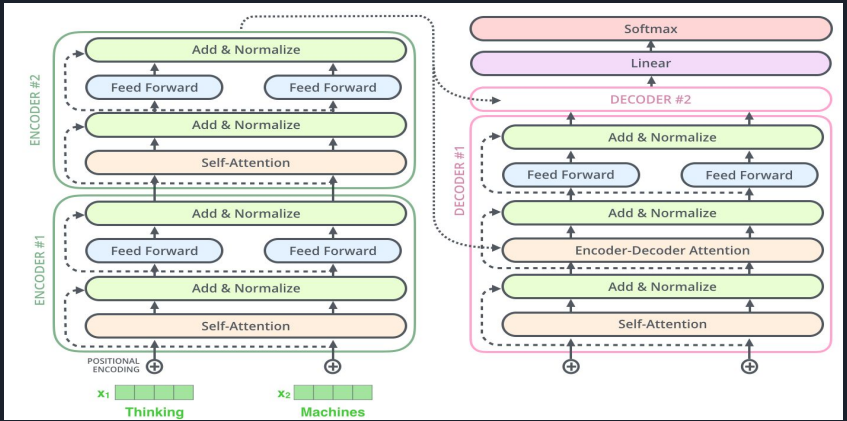
BERT Model

BERT's key technical innovation is applying the bidirectional training of Transformer, a popular attention model, to language modelling. This is in contrast to previous efforts which looked at a text sequence either from left to right or combined left-to-right and right-to-left training. The google paper results show that a language model which is bidirectionally trained can have a deeper sense of language context and flow than single-direction language models.

An approach which is popular in NLP tasks is feature-based training. In this approach, a pre-trained neural network produces word embeddings which are then used as features in NLP models.BERT model here creates those word embeddings which are then passed to a NN.

How BERT works?

BERT makes use of Transformer, an attention mechanism that learns contextual relations between words (or sub-words) in a text. In its vanilla form, Transformer includes two separate mechanisms — an encoder that reads the text input and a decoder that produces a prediction for the task. Since BERT's goal is to generate a language model, only the encoder mechanism is necessary.The Transformer encoder reads the entire sequence of words at once.This characteristic allows the model to learn the context of a word based on all of its surroundings (left and right of the word).



What BERT Loss function focuses on??

1)**Masked LM (MLM)**

Before feeding word sequences into BERT, 15% of the words in each sequence are replaced with a [MASK] token. The model then attempts to predict the original value of the masked words, based on the context provided by the other, non-masked, words in the sequence.

2)**Next Sentence Prediction (NSP)**

In the BERT training process, the model receives pairs of sentences as input and learns to predict if the second sentence in the pair is the subsequent sentence in the original document. A [CLS] token is inserted at the beginning of the first sentence and a [SEP] token is inserted at the end of each sentence.A sentence embedding indicating Sentence A or Sentence B is added to each token.

When training the BERT model, Masked LM and Next Sentence Prediction are trained together, with the goal of minimizing the combined loss function of the two strategies.

Model Structure

BloomsTaxonomy.ipynb - Colaboratory — Mozilla Firefox

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BloomsTaxonomy.ipynb

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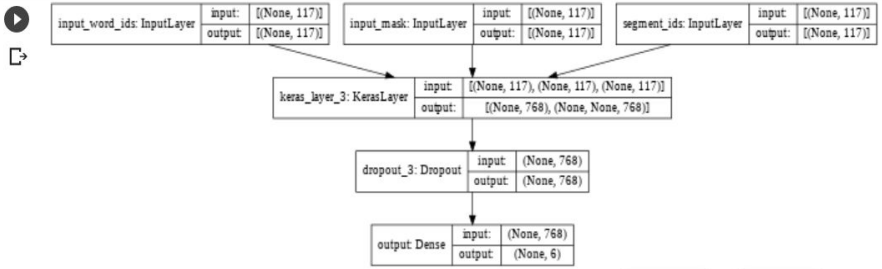

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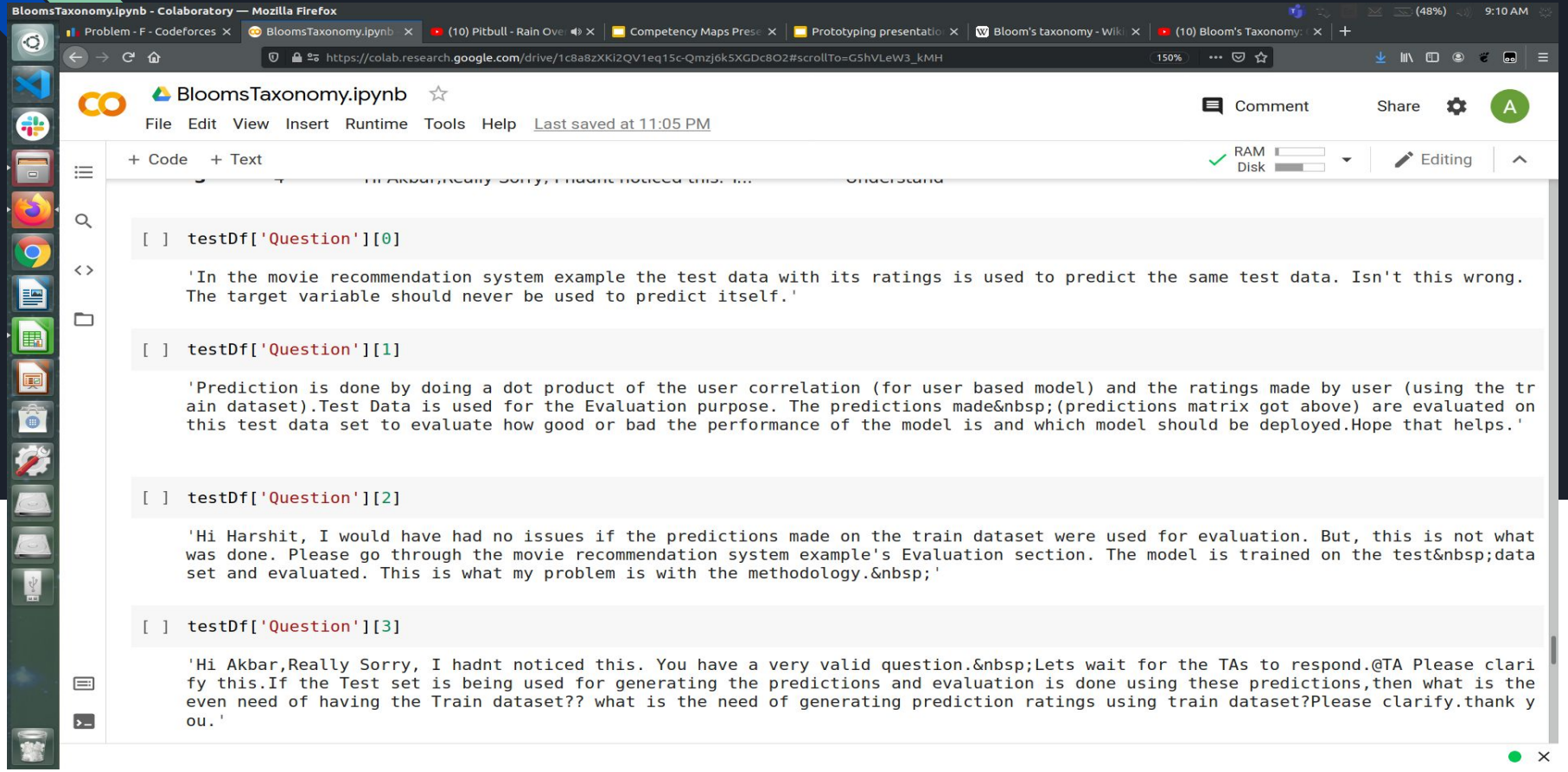
```
[ ] oneHotColumns
```

	Analysis	Application	Evaluation	Knowledge	Synthesis	Understand
0	0	0	0	1	0	0
1	0	0	0	1	0	0
2	0	0	0	1	0	0
3	0	0	0	1	0	0
4	0	0	0	0	0	1
...	...	...	...	...	...	...
663	0	0	1	0	0	0

Questions in Test Dataset



BloomsTaxonomy.ipynb - Colaboratory — Mozilla Firefox

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BloomsTaxonomy.ipynb

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RAM Disk Editing

```
[ ] y=model.predict(X_test)
```

```
WARNING:tensorflow:5 out of the last 5 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7fd68c747050> triggered tf.function retracing. Tracing is expensive and the excessive num
WARNING:tensorflow:5 out of the last 5 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7fd68c747050> triggered tf.function retracing. Tracing is expensive and the excessive num
```

```
[ ] y
```

```
array([[3.3233302e-06, 9.9985003e-01, 3.6101719e-05, 1.0196187e-06,
        4.1705593e-05, 6.7831861e-05],
       [9.0463748e-03, 8.0950066e-02, 8.9724189e-01, 4.5412624e-05,
        1.2649169e-02, 6.6990680e-05],
       [2.9469671e-04, 2.5798636e-03, 9.8251396e-01, 8.1504813e-06,
        1.1386925e-02, 3.2162941e-03],
       [1.6025032e-06, 8.7841463e-06, 9.9986351e-01, 1.0564056e-06,
        1.6359269e-05, 1.0873275e-04]], dtype=float32)
```

```
[ ] mapIndex={
        0:"Analysis",
        1:"Application",
        2:"Evaluation",
        3:"Knowledge",
        4:"Synthesis",
        5:"Understand"
    }
```

```
[ ]
```

```
[ ] finalAnswer=[];
    for arr in y:
      ind=np.argmax(arr);
      print(ind)
      print(mapIndex[ind])
      finalAnswer.append(mapIndex[ind])
```

```
1
Application
2
Evaluation
2
Evaluation
2
Evaluation
```

GITHUB LINK

https://github.com/revengeWillBeTaken/Blooms-Taxonomy/blob/main/BloomsTaxonomy.ipynb