**Medical Question Answering with Transformer Models**

**Dataset**

We used the MedQuAD dataset, which contains over 43,000 real-life patient inquiries categorized into 31 distinct types of questions.

**Models and Hyperparameters**

We fine-tuned three transformer models: BERT, MobileBERT, and RoBERTa. We experimented with different hyperparameters such as the number of encoder layers and dropout rates (0.3 and 0.7).

Bert and other models were given these hyperparameters:  
Sure, here’s a human-readable interpretation of the model arguments:

* **Model Type**: BERT (bert-base-uncased)
* **Model Class**: QuestionAnsweringModel
* **Training Parameters**:
  + Learning Rate: 3e-05
  + Number of Training Epochs: 3
  + Train Batch Size: 12
  + Gradient Accumulation Steps: 8
  + Max Gradient Norm: 1.0
  + Weight Decay: 0.0
  + Warmup Steps: 38
  + Warmup Ratio: 0.06
  + Use Multiprocessing: True
  + Process Count: 14
  + FP16 Precision: True
* **Evaluation Parameters**:
  + Evaluation Batch Size: 100
  + Evaluate During Training: False
  + Evaluate Each Epoch: True
  + Use Cached Eval Features: False
  + Use Multiprocessing for Evaluation: True
  + N Best Size: 5
  + Max Answer Length: 100
  + Null Score Diff Threshold: 0.0
* **Optimizer & Scheduler**:
  + Optimizer: AdamW
  + Scheduler: Linear Schedule with Warmup
  + Adam Betas: [0.9, 0.999]
  + Adam Epsilon: 1e-08
* **Early Stopping Parameters**:
  + Early Stopping Metric: Correct
  + Early Stopping Metric Minimize: False
  + Early Stopping Patience: 3
  + Early Stopping Delta: 0
* **Saving & Loading**:
  + Save Best Model: True
  + Save Model Every Epoch: True
  + Save Optimizer and Scheduler: True
  + Save Steps: 2000
  + Best Model Directory: outputs/best\_model
  + Output Directory: outputs/
  + Overwrite Output Directory: True
* **Wandb Parameters**:
  + Wandb Project: MedQuad

Vocab\_list:

1955

20th

guess

officially

memorial

naval

initial

##ization

whispered

median

engineer

##ful

sydney

##go

columbia

strength

300

1952

tears

senate

00

card

asian

agent

**Training and Evaluation**

The models were trained on 75% of the data and tested on the remaining 25%. We used “wandb” for training visualization. The models’ performance was evaluated using BLUE Score and Rouge metrics.

Following are the results of the training:

Nbest\_predictions:

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"3634": [

{

"text": "",

"probability": 0.9999999958569317,

"start\_logit": 7.01953125,

"end\_logit": 6.95703125

},

{

"text": "Today, many different types of medicines are available to control high blood pressure. These medicines work in different ways. Some lower blood pressure by removing extra fluid and salt from your body. Others affect blood pressure by slowing down the heartbeat, or by relaxing and widening blood vessels. Often, two or more drugs work better than one. Here are the types of medicines used to treat high blood pressure.",

"probability": 3.915203843150745e-09,

"start\_logit": -1.0341796875,

"end\_logit": -4.34765625

},

{

"text": "Some lower blood pressure by removing extra fluid and salt from your body. Others affect blood pressure by slowing down the heartbeat, or by relaxing and widening blood vessels. Often, two or more drugs work better than one. Here are the types of medicines used to treat high blood pressure.",

"probability": 9.091521435183207e-11,

"start\_logit": -4.796875,

"end\_logit": -4.34765625

},

{

"text": "These medicines work in different ways. Some lower blood pressure by removing extra fluid and salt from your body. Others affect blood pressure by slowing down the heartbeat, or by relaxing and widening blood vessels. Often, two or more drugs work better than one. Here are the types of medicines used to treat high blood pressure.",

"probability": 7.685792685618532e-11,

"start\_logit": -4.96484375,

"end\_logit": -4.34765625

},

{

"text": "Others affect blood pressure by slowing down the heartbeat, or by relaxing and widening blood vessels. Often, two or more drugs work better than one. Here are the types of medicines used to treat high blood pressure.",

"probability": 6.009128734827783e-11,

"start\_logit": -5.2109375,

"end\_logit": -4.34765625

}

],

Prediction\_tests, first few 100 lines:

{

"3634": "",

"15104": ".",

"4395": "",

"10274": "Glutaric acidemia type I occurs in approximately 1 of every 30,000 to 40,000 individuals. It is much more common in the Amish community and in the Ojibwa population of Canada, where up to 1 in 300 newborns may be affected.",

"149": ".",

"1624": ".",

"7176": ".",

"7261": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"14711": ".",

"6728": ".",

"123": ".",

"8337": "These resources address the diagnosis or management of Mainzer-Saldino syndrome: - MedlinePlus Encyclopedia: Electroretinography - National Institutes of Diabetes and Digestive and Kidney Diseases: Treatment Methods for Kidney Failure in Children These resources from MedlinePlus offer information about the diagnosis and management of various health conditions: - Diagnostic Tests - Drug Therapy - Surgery and Rehabilitation - Genetic Counseling - Palliative Care",

"10146": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"15231": "How might cryptogenic organizing pneumonia be treated? The treatment of cryptogenic organizing pneumonia (COP) generally depends on the severity of the condition. For example, people who are mildly affected may simply be monitored as some cases can improve on their own. Unfortunately, the majority of people with COP have persistent and/or progressive symptoms that will require therapy. In these cases, oral or intravenous glucocorticoids can be given which often result in rapid improvement of symptoms.",

"7198": ".",

"6013": ".",

"2864": ".",

"5549": "Agency",

"4034": ".",

"15492": "",

"733": ".",

"15465": ".",

"102": "",

"10665": ".",

"1475": ".",

"15190": "SAPHO syndrome involves any combination of: Synovitis (inflammation of the joints), Acne, Pustulosis (thick yellow blisters containing pus) often on the palms and soles, Hyperostosis (increase in bone substance) and Osteitis (inflammation of the bones). The cause of SAPHO syndrome is unknown and treatment is focused on managing symptoms.",

"11599": "What causes fumarase deficiency? Mutations in the FH gene cause fumarase deficiency. The FH gene provides instructions for making an enzyme called fumarase, which participates in a series of reactions allowing cells to use oxygen and generate energy. Mutations in the FH gene disrupt the enzyme's ability to do its job. Disruption of the process that generates energy for cells is particularly harmful to cells in the developing brain, thus resulting in the signs and symptoms of fumarase deficiency.",

"1944": "-",

"1208": "Enzyme replacement therapy is very beneficial for type 1 and most type 3 individuals with this condition. Successful bone marrow transplantation can reverse the non-neurological effects of the disease, but the procedure carries a high risk and is rarely performed in individuals with Gaucher disease.",

"2861": "",

"476": "The prognosis for individuals with LNS is poor. Death is usually due to renal failure in the first or second decade of life.",

"5943": "",

"13095": ".",

"2227": "",

"12815": "What causes essential tremor? The causes of essential tremor are unknown. Researchers are studying several areas (loci) on particular chromosomes that may be linked to essential tremor, but no specific genetic associations have been confirmed. Several genes, as well as environmental factors, are likely involved in an individual's risk of developing this complex condition.",

"8481": ".",

"8222": "These resources from MedlinePlus offer information about the diagnosis and management of various health conditions: - Diagnostic Tests - Drug Therapy - Surgery and Rehabilitation - Genetic Counseling - Palliative Care",

"16384": ".",

"7144": "Lujan syndrome appears to be an uncommon condition, but its prevalence is unknown.",

"13308": ".",

"6108": "",

"6679": "The worldwide prevalence of autosomal recessive hypotrichosis is unknown. In Japan, the condition is estimated to affect 1 in 10,000 individuals.",

"10786": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"1767": "The",

"5376": "Diseases",

"16159": ".",

"4450": "",

"6611": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"828": "The prognosis for MLD is poor. Most children within the infantile form die by age 5. Symptoms of the juvenile form progress with death occurring 10 to 20 years following onset. Those persons affected by the adult form typically die withing 6 to 14 years following onset of symptoms.",

"7275": ".",

"12210": "",

"15208": ".",

"6866": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"15540": ".",

"12737": ".",

"3269": "",

"9393": ".",

"6661": "This condition is inherited in an autosomal dominant pattern, which means one copy of the altered gene in each cell is typically sufficient to cause the disorder. Almost everyone with a mutation in the PNKD gene will develop familial paroxysmal nonkinesigenic dyskinesia. In all reported cases, an affected person has inherited the mutation from one parent.",

"5133": "Summary",

"15181": "",

"2676": ".",

"3021": "",

"5294": "Summary",

"6561": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"5194": "Prevention",

"8892": "These",

"7076": ".",

"6702": "These",

"14611": "",

"13663": "",

"8184": "Aplasia cutis congenita affects approximately 1 in 10,000 newborns. The incidence of the nonsyndromic form is unknown.",

"9341": "This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.",

"7383": "",

"10162": "These resources address the diagnosis or management of inclusion body myopathy 2: - Gene Review: Gene Review: GNE-Related Myopathy - Genetic Testing Registry: Inclusion body myopathy 2 - Genetic Testing Registry: Nonaka myopathy These resources from MedlinePlus offer information about the diagnosis and management of various health conditions: - Diagnostic Tests - Drug Therapy - Surgery and Rehabilitation - Genetic Counseling - Palliative Care",

"5106": "Institute",

"8459": "Hirschsprung disease occurs in approximately 1 in 5,000 newborns.",

"2119": ".",

"13761": ".",

"5437": "Summary",

"3000": ".",

"8523": ".",

"10550": ".",

"7248": "",

"13867": "How is Tay-Sachs disease inherited? This condition is inherited in an autosomal recessive pattern, which means two copies of the gene in each cell are altered. Most often, the parents of an individual with an autosomal recessive disorder are carriers of one copy of the altered gene but do not show signs and symptoms of the disorder.",

"1199": "There are no standard treatments for hereditary neuropathies. Treatment is mainly symptomatic and supportive. Medical treatment includes physical therapy and if needed, pain medication. Orthopedic surgery may be needed to correct severe foot or other skeletal deformities. Bracing may also be used to improve mobility.",

"9320": ".",

"4982": "Dislocations",

"6029": "Stve-Wiedemann syndrome is a rare condition that has been found worldwide. Its prevalence is unknown.",

"322": ".",

"10678": ".",

"88": "After",

"6507": "",

"12309": "",

"9952": "These",

"8940": ".",

"2177": ".",

"2183": "Dumping syndrome occurs when food, especially sugar, moves too fast from the stomach to the duodenumthe first part of the small intestinein the upper gastrointestinal (GI) tract. This condition is also called rapid gastric emptying. Dumping syndrome has two forms, based on when symptoms occur: - early dumping syndromeoccurs 10 to 30 minutes after a meal - late dumping syndromeoccurs 2 to 3 hours after a meal",

"3": ".",

"4156": "",

"11912": "",

"254": ".",

"11859": "",

Following special tokens were used in classification where cls is the classification token:

{

"cls\_token": "[CLS]",

"mask\_token": "[MASK]",

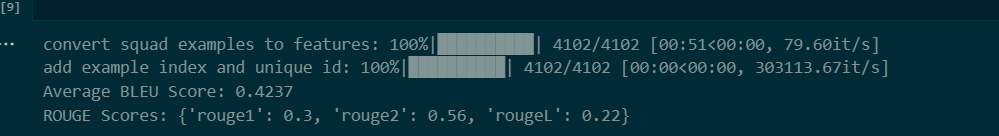
"pad\_token": "[PAD]",

"sep\_token": "[SEP]",

"unk\_token": "[UNK]"

}

**Results**

The results, the BLUE Score and Rouge scores are presented in the report. Graphs from W&B showing the training progress and other insights are also included. First Model was Bert, Second was MobileBert and so on. A screenshot of a computer

Description automatically generated