

# Generative AI model using GPT2 on Quora Question-Answer Dataset

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# Models

- Models were trained on T5 and GPT2, for the [Quora Question-Answer Dataset](#).
- The **final model selected was GPT2**.
- GPT2 is a model for Natural Language Processing tasks, such as question answering, reading comprehension, summarization, etc.
- GPT-2 uses attention mechanisms to focus into sections of more relevant texts only, and lesser on the less relevant texts.

# Literature Survey

- What is **Lemmatization**?

<https://sciencedirect.com/topics/social-sciences/lemmatization>

- “Lemmatization is the process of reducing words to their base or root form to facilitate analysis”

- Understanding **Back Translation**: <https://aclanthology.org/D18-1045.pdf>

- “Back translation is the technique in which one sentence is translated into another language, and then translated back again to the original language, using some language translators.”

- Paper of **GPT-2** (Language models are unsupervised multitask learners):  
[https://d4mucfpksywv.cloudfront.net/better-language-models/language\\_models\\_are\\_unsupervised\\_multitask\\_learners.pdf](https://d4mucfpksywv.cloudfront.net/better-language-models/language_models_are_unsupervised_multitask_learners.pdf)

- “Natural Language Processing tasks, such as question answering, reading comprehension, summarization, etc.”

# Methodology

# Data Preprocessing and Cleaning

- Lemmatization: to reduce words to their root words, or lemmas
- Tokenization
- Emoji removal, URL removal, Hindi text removal: as they were irrelevant

# Model training

The dataset was divided into two parts in ratio 8:2 for the train and validation sets respectively.

The GPT model was trained for 2 epochs.

*Hyperparameter tuning:* The max\_length of the tokenized input was set to 1024, and the batch size was set to 2. The max\_length input was key in the model performance; the higher the max\_length of the tokenized\_input, the model is able to get a bigger context of the question/answer, and thus its performance improves. It needs to be handled with care as it can lead to overfitting as well.

## Results

After the final epoch of training the GPT2 model, the loss on the training set was 0.609, and the validation set loss was also around 0.603.

Since the loss of the model was not high, this means that the model had learned significantly.

And since the train and val set losses were similar, this means that the model was not overfitting, but may be learning properly.

## ROUGE scores

The metrics ROUGE1, ROUGE2, and their corresponding precision, recall and F-scores were used to evaluate the model on 197 validation set examples. I could not validate the model on all the examples because it was taking a lot of time to validate each row of the data. The average scores are shown below:

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Rogue1 scores (order: precision, recall, f): 0.259 0.217  
0.157
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Rogue2 scores (order: precision, recall, f): 0.058 0.036  
0.029
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These scores must be considered in conjunction with human evaluations to get a comprehensive understanding of the model performance.



Some of the answers produced by the GPT model are shown next

## Question: What industry needs lead generation and marketing?

Answer: Lead generation and marketing are two different field of business. Lead generation and marketing are two different fields, one is to connect with potential customer and build brand awareness. Lead generation and marketing are two different field that are both essential for business to grow and expand their reach. Here are some key point to consider: 1. Research and Optimize Your Website: Before starting your website, it's important to understand the content you're promoting. This will help you tailor your content to meet the need of your audience. 2. Create a Content Strategy: Develop a content strategy that outline your content strategy and how it will impact your business. This includes creating high-quality, engaging, and engaging content that resonates with your target audience. 3. Promote Your Products: Share your product or service to attract new customers. This can include product reviews, reviews, and other relevant information. 4. Engage in Social Media: Engaging in social medium can be an effective way to reach potential customers. Engaging in conversation about your product or service can help build relationship with your audience. 5. Use SEO Techniques: Use keyword research to identify relevant keywords that are relevant to your website's search engine results. This can include optimizing your website's

Question: how to use a proxy?

Answer: Proxy server are a type of web application that us the internet. They are used for various purposes, such as browsing, accessing websites, or accessing file on the Internet. Proxy server are used by various service provider to provide access to website and other data. They are used in various way to protect your privacy and security from unauthorized access. Some popular proxy server include Google Chrome, which provides a wide range of proxy server for various purposes. These proxy server allow user to browse the internet without any restriction or restrictions. However, some common practice involve using different proxies, such an IP address (IP), a well a setting up VPNs, which can be used to track and access website from anywhere. Additionally, these proxy server allow user to access website directly through their mobile devices, which can help them stay connected with others online.

Question: What are the must-have iPhone apps?

Answer: There are many must-have iPhone apps available, including Google Play Store and Apple Music. Here are some of the most popular and widely used apps for Android: 1) Apps for music streaming: Spotify, YouTube Video Player (iTunes), and Apple Music playlists can be a great way to listen to your favorite song or create a playlist that is more relevant than others. 2)(Music streaming app): Spotify offer a wide range in it genre such as classical rock/rock, electronica, and pop. It's important to note these apps are not intended solely on a specific device, and they may require additional processing and maintenance to ensure they are user-friendly and user-friendly. 3.) App Store: Apple Store provides a wide selection of apps for Android devices, including iWatch TV, iWatch Pro Max HD, and iMovie. These apps are designed specifically for Android devices, and are designed with the goal of providing a seamless experience for both users' needs.

Question: What is the color code for 52M ohm?

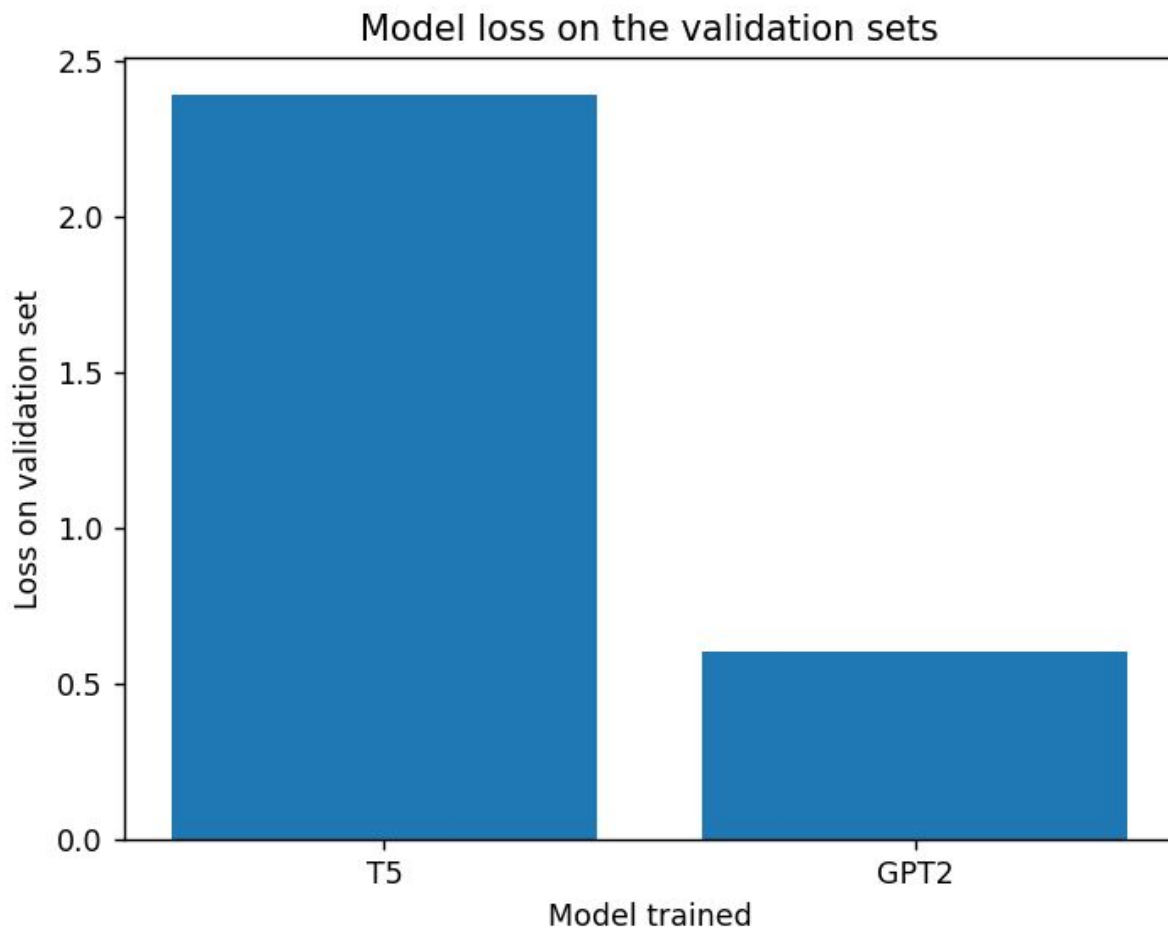
Answer: I have a black and white laptop with a black screen.

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The answers to the first three questions are meaningful, while the answer to the this last question is incorrect

# Visualization

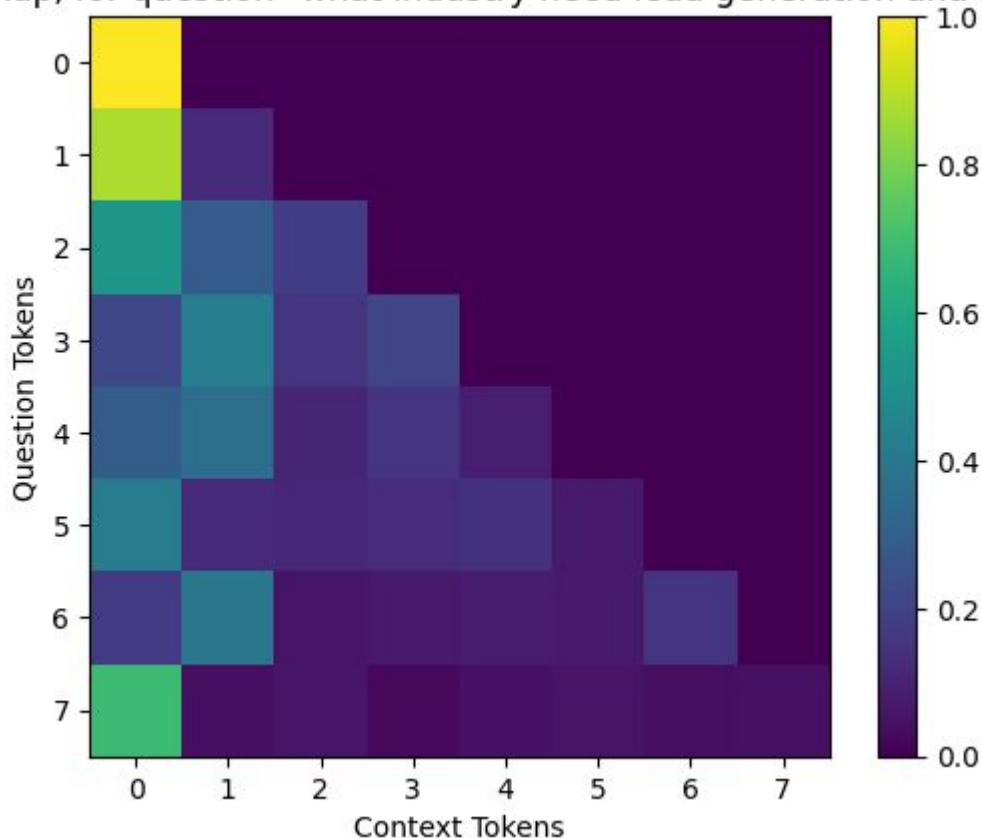
A lower loss in GPT compared to T5 implies a better QA understanding of the GPT model compared to T5 model. This implies that the GPT model generalizes better than the T5 model.



# Attention Heatmap

Note that the tokens “what”, “industry” and “marketing” are relatively hot, implying that the model gave more attention to them.

Attention Heatmap, for question "what industry need lead generation and marketing?"



# Insights and Recommendations

- Data Augmentation: Techniques such as back-translation can be incorporated to enhance the model performance
  - Back translation is the technique in which one sentence is translated into another language, and then translated back again to the original language, using some language translators. This helps in generating new different sentences for the same questions/answers, thus augmenting the data.
- It is to be importantly noted that the quora question-answers dataset contains answers from common people, and not necessarily from domain-experts of the question asked. This means that, if there are 50 answers to one question (say), then not all the answers are the same, and this means that the model learns all the answers, whether they are correct or not. This hampers the performance of the model. As a resolution to this, the dataset must be manually curated (by domain-experts) to remove all the incorrect answers. This will improve the model performance.



# Insights and Recommendations

- URLs may be important to keep in the data, so do not remove them from the data. This may hamper the performance of the model somewhat on some inputs, but could lead to slightly more contextual answers and may thus improve overall ROGUE score.
- Similarly it is not advised to implement stop-word removal, as it can potentially remove the context (meaning) of a sentence, in my opinion. As an example, the sentence "Today it may rain because the sky is cloudy", after stop word removal, will look something like this: "Today rain sky cloudy", I don't think this is useful for a generative AI model which needs to generate human readable texts. Stop-word removal may be useful for classification related tasks, not here.
- Use techniques such as classification models to classify the dataset into some fixed number of categories, and then train the gen-AI model along with these classification information.

# Conclusion

A model was trained for the question-answer Quora dataset. The model may not be easy to train, because it contained a wide range of information, and, the correctness of the answers is a challenge to be addressed for next models, which can improve the performance of the model.

Thank you