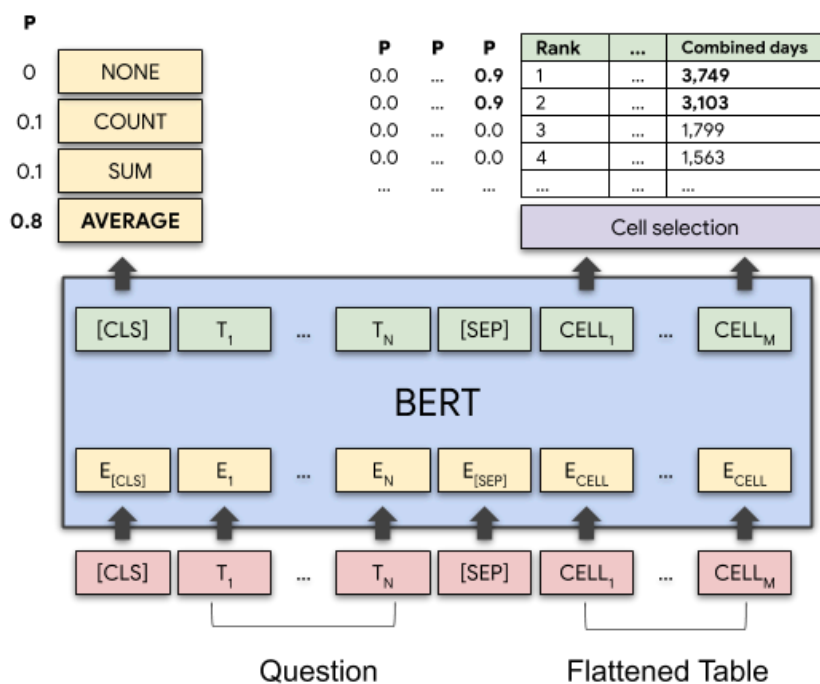


TAPAS Pretrained Model for Table Question Answering

TAPAS (Tabular Pretrained Language Model) is a transformer-based model developed by Google Research for answering natural language questions over tabular data. Unlike traditional NLP models, TAPAS incorporates table structure into its attention mechanism, allowing it to perform reasoning over rows, columns, and individual cells.

It builds on BERT, with specific extensions such as segment embeddings for columns and rows, making it suitable for structured data in CSVs, spreadsheets, and HTML tables.



Tapas Architecture

Key Features

- **Natural Language Querying over Tables:** Allows users to ask questions like "Which actor has the most movies?" directly on tables.
- **No Table-to-Text Conversion Needed:** Processes tables directly without needing to convert them into natural language.
- **Aggregation Support:** Supports aggregate queries like COUNT, SUM, and AVERAGE.
- **Weakly Supervised Training:** Trained using weak supervision over Wikipedia tables and question-answer pairs.
- **Supports Multiple Question Formats:** Handles yes/no, factoid, and aggregative questions.
- **Scalability:** Can batch-process multiple queries at once for the same table.

Model Variants

TAPAS comes in several variants based on model size and fine-tuning datasets:

Variant Name	Description
tapas-small	Lightweight model (smaller BERT base) for quick inference.
tapas-base	Standard BERT base size with table-specific training.
tapas-large	Large BERT-based model with more accurate predictions.
finetuned-wtq	Fine-tuned on the WikiTableQuestions dataset (factoid QA).
finetuned-sqa	Fine-tuned on the Sequential Question Answering dataset (multi-turn QA).
finetuned-tabfact	Fine-tuned for Table Fact Verification (true/false classification over tables).

These models are available on the Hugging Face model hub, and can be used directly or further fine-tuned for specific domains.

Use Cases of TAPAS

TAPAS is useful in scenarios where natural language interaction with structured data is beneficial:

- **Business Dashboards:** Ask questions about sales or financial data without SQL.
- **Customer Support:** Retrieve data from structured FAQs or product comparison tables.
- **Healthcare:** Query over patient or trial records organized in tables.
- **Education:** Assist in querying educational datasets or grading tables.
- **Data Journalism:** Quickly analyze statistics and datasets in tabular form.

Fine-Tuning Process

To adapt TAPAS to domain-specific data, fine-tuning can be performed using triplets of:

- A pandas DataFrame representing the table,
- A natural language query,
- And the correct cell(s) or aggregate as the answer.

Fine-tuning helps improve accuracy in domains with custom vocabulary or structure. Hugging Face's Trainer API or custom PyTorch loops can be used for training.

Implementation Summary

In this notebook implementation:

- TAPAS model `tapas-large-finetuned-wtq` was loaded from Hugging Face.
- A sample table with actor names and movie counts was created using pandas.
- Natural language queries were passed with the table to the tokenizer.
- The model returned predictions: cell coordinates and aggregation operation indices.
- Results were decoded into readable answers using TAPAS utilities.

Major Findings

- TAPAS answers questions on tables without SQL or database systems.
- The pretrained model already achieves high accuracy on straightforward queries.
- Aggregation operations like COUNT and SUM were predicted correctly.
- Works effectively with small in-memory tables and pandas DataFrames.

Conclusion

TAPAS revolutionizes how users interact with tabular data by allowing natural language querying. Its seamless integration with Hugging Face Transformers, support for aggregation operations, and robust pretrained variants make it a strong tool for building intelligent table-based QA systems.

This project demonstrates the use of TAPAS in a simplified scenario and can be extended for enterprise applications like intelligent dashboards, domain-specific search tools, and AI-powered data assistants.

References

1. https://huggingface.co/transformers/model_doc/tapas.html
2. <https://huggingface.co/models?search=tapas>
3. Image Source:
<https://research.google/blog/using-neural-networks-to-find-answers-in-tab>