MLOPS

Presentation on TENSORBOARD

Presented by:
Harsh Lilha - 1RV22AI018
Chinmaya BJ - 1RV22AI014
Sujay AK - 1RV22AI059
Pranshu Bhatt - 1RV22AI071

Presented to:
Dr S Anupama Kumar

What is TensorBoard?

- TensorBoard is a visualization toolkit that helps monitor and analyze machine learning experiments in real time.
- Provides visualizations for metrics like accuracy, graphs, histograms, and model structure to better understand training performance.
- Allows easy tracking of experiment progress, comparing runs, and identifying bottlenecks or anomalies in model training.

Why we used Tensorboard instead of BentoML

Ease of Implementation:

- BentoML's setup for deployment is complex, while TensorBoard integrates easily for monitoring and visualization.

Focus on Analysis:

- The project prioritized job description and resume analysis using pre-trained models, and TensorBoard effectively visualized performance metrics for debugging and optimization.

Resource Efficiency:

- BentoML's packaging and API setup were resource-intensive; TensorBoard offered a lightweight solution for progress tracking.

Key Features of TensorBoard

- Real-time visualization of performance metrics for efficient debugging and optimization.
- Efficient handling of port conflicts with dynamic port assignment to ensure smooth execution.
- Optimized to leverage GPU acceleration (e.g., CUDA) for faster training and visualization, with seamless issue resolution.
- Efficient Data Handling: Implements fast data loading for improved TensorBoard performance, with flexibility to disable experimental features if necessary.
- Hyperparameter Tuning: TensorBoard supports hyperparameter tracking, allowing comparison of multiple runs to identify the best-performing model configurations.

Where is TensorBoard Used?

General Uses of TensorBoard:

- **Monitor Model Performance**: Monitor metrics like resume scores , Q&A evaluation scores and give the combined results of both the scores.
- **Hyperparameter Tuning**: By visualizing and comparing results across different hyperparameter settings, TensorBoard makes it easy to identify the best combination of parameters for your model.
- **Scale Easily**: TensorBoard is designed to handle projects of all sizes, from small-scale prototypes to large-scale production systems.
- **Share Insights**: TensorBoard provides clear and interactive visualizations that may be helpful in decision-making.

Where is TensorBoard Used?

Case-Study of Tensorboard:

A recruitment platform aims to streamline its hiring process by automating job description (JD) analysis, resume matching, and interview preparation. They need scalable, reliable, and collaborative deployment of ML models to process high volumes of data in real-time while maintaining flexibility for cloud and local environments.

Where is TensorBoard Used?

Uses of TensorBoard in given Case-Study:

1. Visualizing Scalar Metrics:

- Track performance metrics like scores for resumes, Q&A evaluations, and overall results.

2. Comparative Analysis:

- Compare candidates' overall scores using bar charts logged to TensorBoard.
- Generate visual insights to help recruiters or system users make informed decisions.

3. Image Summaries:

- Display custom visualizations, like bar charts or other plots, directly in TensorBoard.

4. Real-Time Monitoring:

- TensorBoard provides real-time updates, enabling recruiters to monitor scores or progress dynamically as candidates are assessed.

5. Enhanced Presentation:

- TensorBoard can act as a reporting tool to present insights from the evaluation process in a professional and interactive manner.

Where is TensorBoard Used?

Other applications of TensorBoard:

1. **Speech Recognition Systems**

- Monitor metrics like word error rate and training loss during model development.
- Visualize model architecture to optimize for real-time voice-to-text performance.

1. **Fraud Detection in Finance**

- Track precision, recall, and F1-score for fraud detection models.
- Compare experiments to identify the best-performing algorithm for real-time fraud monitoring.

1. **Recommendation Engines**

- Visualize embeddings for users and products to ensure effective clustering.
- Monitor training progress and tune hyperparameters for better recommendations.

1. **Predictive Maintenance in Manufacturing**

- Track metrics like mean time between failures (MTBF) predictions.
- Debug time-series models by analyzing weights and gradients.

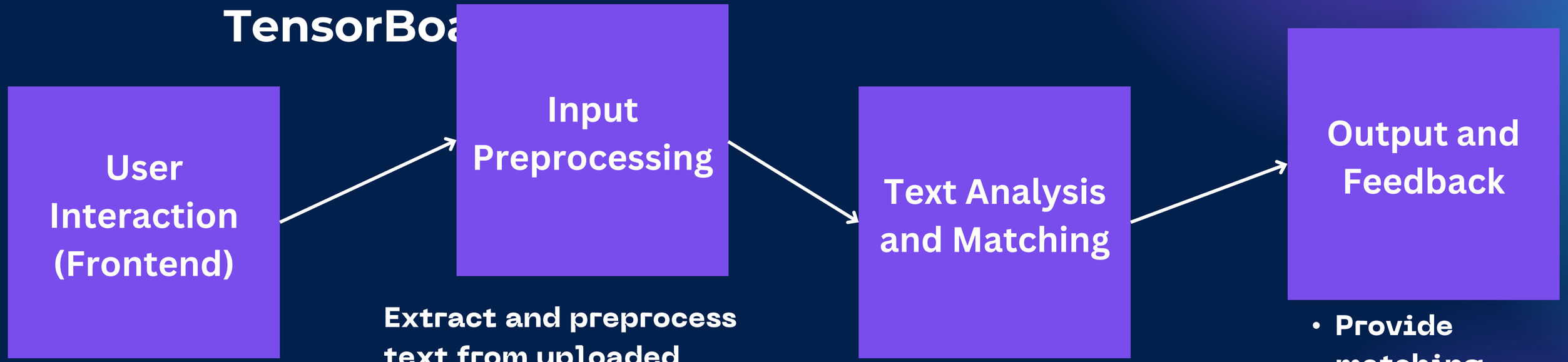
Where is TensorBoard Used?

Other applications of TensorBoard:

5. **Natural Language Processing (NLP) Applications**
   - Track metrics like BLEU scores for text generation or accuracy for classification tasks.
   - Visualize embeddings for better understanding of word relationships in NLP tasks.
6. **Real-Time Analytics for IoT**
   - Debug and optimize lightweight models deployed on edge devices by tracking their performance.
   - Compare runs to ensure minimal latency and accurate sensor data processing.
7. **Image Recognition Systems**
   - Monitor metrics like object detection accuracy and localization errors.
   - Visualize model architecture and feature maps to improve real-time classification.

Where is TensorBoard Used?

Workflow of the project surrounding TensorBoa



Users upload job descriptions (JD) and resumes through an interface built with Streamlit or Gradio.

Extract and preprocess text from uploaded documents using pdfplumber and spaCy.

Use pre-trained models to analyze and match job descriptions with resumes.

- Provide matching scores, generate interview questions, and log results for debugging using TensorBoard.

Why TensorBoard?

Real-Time Visualization:

- TensorBoard provides immediate feedback on metrics like scores and comparisons.
- Changes can be monitored dynamically, making it easier to evaluate results.

Scalable Monitoring:

TensorBoard works well with both small and large datasets and models:

- Organized Logging: It saves and displays data in a clear and easy-to-understand way.
- Handles Complexity: It works smoothly even for complicated projects without slowing down.

Customizable Dashboards:

- TensorBoard supports adding custom plots (e.g., bar charts of candidate scores) and text summaries, making it versatile for your specific needs.

Requirements

Step 1: Install TensorBoard

- Make sure you have Python ≥ 3.6 installed.
- pip install tensorboard

Step 2: Add TensorBoard Callback to Code

- Set up a Logging Directory:
- Ensure the system has permissions to write logs to the specified directory.
- Example: /content/logs for Colab or logs/ for local directories.
- Integrate File Writer: Use tf.summary.create_file_writer() to create a file writer for logging metrics.

Step 3 : Launch TensorBoard on Default Port (6006)

- After training your model, start TensorBoard to visualize the logs
- tensorboard --logdir=/content/logs This starts TensorBoard on the default port 6006. Open http://localhost:6006 in your browser to view the dashboard.
- tensorboard --logdir=/content/logs --port=7000 start tensorboard in different port , if 6066 is unavailable

Requirements

Step 4: Analyze Metrics and Visualizations

Logging Metrics:

- Custom scalar metrics, e.g., loss, accuracy, or other performance indicators.

Model Architecture Visualization:

- Use tf.summary to visualize model graphs.

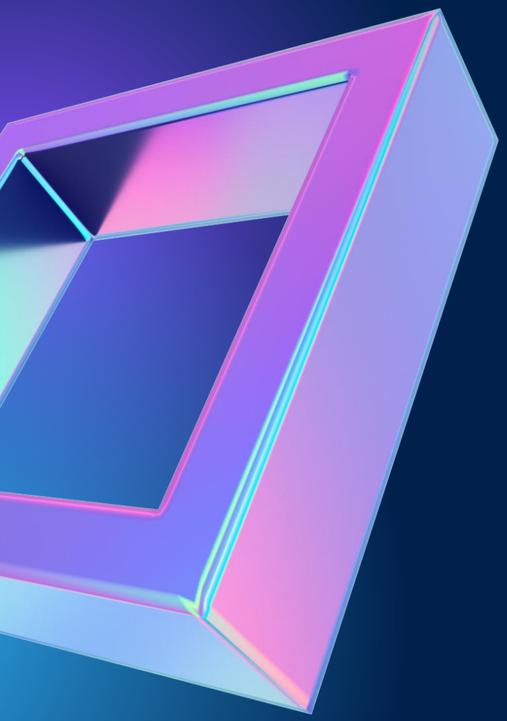
Hyperparameter Tuning:

- Log and compare runs with different parameter configurations.

References:

- TensorBoard documentation : https://github.com/tensorflow/tensorboard
- Getting started with TensorBoard : https://www.tensorflow.org/tensorboard
- TensorBoard Tutorial : https://www.youtube.com/watch?v=k7KfYXXrOj0

With good data and the right technology, people and institutions today can still solve hard problems and change the world for the better.



Thank You