**Final Project Proposal**

**Course:** AAI-511 – Neural Networks and Deep Learning  
**Instructor:** Dr.Esmaeili  
**Students:** Iman Hamdan, Matt Hashemi

**Project Title:**

**Fine-Tuning Transformer Models for Financial Sentiment Classification: A Deep Learning Approach**

*Note: After discussing with the instructor and receiving approval, this project will focus on a different topic than the originally proposed music classification task. This proposal applies deep learning (transformer-based models) to financial text sentiment analysis.*

### **1. Project Objective**

The objective of this project is to build and fine-tune a deep learning model, based on BERT (Bidirectional Encoder Representations from Transformers), for sentiment analysis on financial texts. The model will classify input text (e.g., financial news, journal abstracts, and project summaries) into **positive**, **negative**, or **neutral** sentiment categories.

The project aims to demonstrate an application of transformer-based models in specialized NLP domains, showing how deep learning can support faster, automated interpretation of sentiment in research-heavy industries such as finance.

### **2. Motivation**

Sentiment analysis plays a crucial role in financial decision-making. Investors, analysts, and project evaluators increasingly rely on NLP tools to extract insights from large volumes of unstructured financial documents. BERT-based models have proven effective in general NLP tasks, and domain-specific versions such as **FinBERT** have shown strong performance in financial text classification. This project offers both academic depth and practical relevance, especially for AI use cases in business intelligence.

### **3. Proposed Workflow**

**Step 1 – Dataset Preparation:**

* Use a labeled financial sentiment dataset, such as the **Financial PhraseBank**, or construct a custom dataset using publicly available financial news and manual annotation.
* Perform preprocessing steps: cleaning, tokenization, and formatting for BERT input.

**Step 2 – Model Fine-Tuning:**

* Start with a pre-trained transformer model: options include bert-base-uncased, FinBERT, or DistilBERT.
* Fine-tune on the training set using Hugging Face’s Transformers library.
* Apply appropriate hyperparameters (learning rate, epochs, batch size) and track performance metrics.

**Step 3 – Model Evaluation:**

* Use metrics such as **accuracy**, **F1 score**, **precision**, and **recall** to evaluate performance on a validation/test set.
* Generate confusion matrix and classification report for further analysis.

**Step 4 – Deployment Simulation:**

* Set up a simple REST API using **Flask** or integrate with **n8n** to simulate how the model could be used in real-time sentiment classification.
* Provide input-output examples and show usability from an end-user’s perspective.

### **4. Tools and Frameworks**

* **Python**, **PyTorch** or **TensorFlow**
* **Hugging Face Transformers**
* **scikit-learn** (for evaluation)
* **Pandas**, **NumPy** (for preprocessing)
* **Flask**, **n8n**, or **Streamlit** for minimal deployment

### **5. Deliverables**

* Jupyter Notebook (or Python script) with full training and evaluation pipeline
* Trained model checkpoint
* Evaluation report with metrics and visualizations
* (Optional) Live demo or simulation of the deployed model
* Final project report (PDF) detailing all steps, results, and reflections

### **6. Expected Challenges**

* Obtaining sufficient domain-specific, labeled financial data
* Preventing overfitting due to small dataset sizes
* Maintaining class balance during training
* Evaluating generalizability across different financial topics

### **7. Learning Outcomes**

By completing this project, I aim to:

* Apply transformer-based deep learning models to domain-specific NLP tasks
* Gain experience in model fine-tuning and evaluation
* Understand deployment considerations for applied NLP tools
* Explore interdisciplinary AI applications at the intersection of finance and research

**8. Relevance to Course Objectives**

This project aligns with the course’s focus on neural networks and deep learning by leveraging transformer architectures, specifically BERT. It involves transfer learning, model fine-tuning, and evaluation—all critical skills in advanced deep learning.