Task for Real-time Multimodal Fake News Classification

As part of building the **real-time multimodal fake news classification system**, you will be working with **both text and image data** from news articles to enhance the detection process.

Duration: 1 day (can be adjusted based on preference)
Target Audience: Mid-to-Senior Management, Engineers, and Operations Teams

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Dataset for Multimodal Fake News Detection:

- Use the following datasets, which provide **image and text data of news articles**:
    - Weibo Fake News Detection Dataset (Text + Image)
    - Fakeddit Dataset (Text + Image)

Three Key Focus Areas:

1. **Image + Text Data**: Focus on handling both modalities to extract relevant features from both text and images.
2. **Real-time Processing**: Ensure that the system processes the news **in real-time** and provides results instantly.
3. **Model Deployment**: After developing the model, focus on optimizing it for **real-time inference and deployment**.

Task Instructions for Model Implementation

1. **Task 1: Environment Setup**
    - Set up a development environment with necessary libraries (transformers, torch, tensorflow, opencv, etc.).
    - Verify your setup using sample input data.
2. **Task 2: Data Preprocessing**
    - **Text Preprocessing**:
        - Tokenize the news text data using a suitable tokenizer (e.g., RoBERTa from Hugging Face).
        - Ensure the text is cleaned, tokenized, and padded as per the model's requirements.
    - **Image Preprocessing**:
        - Resize all images to a standard size (e.g., 224x224 for ResNet input) and normalize the pixel values.
3. **Task 3: Feature Extraction**

- Extract features from text using a pre-trained **RoBERTa** model.
- Extract features from images using a pre-trained **ResNet** model.

4. **Task 4: Attention Mechanism and Feature Fusion**
   - Implement an attention mechanism to weigh and fuse features from both modalities (text and images).
   - Ensure the fused features represent the combined data effectively for classification.
5. **Task 5: Classification Layer**
   - Build a classifier using a softmax activation function to classify news as **Fake** or **Real** based on the fused features.
6. **Task 6: Real-time Inference**
   - Develop a pipeline that can take real-time input (news text and image) and provide a classification result instantly.
   - Optimize the model for real-time execution, ensuring low latency during inference.
7. **Task 7: Model Evaluation**
   - Evaluate the model using metrics like **accuracy**, **precision**, **recall**, and **F1-score**.
   - Conduct testing on validation and test sets, ensuring the model performs well with real-time data.
8. **Task 8: Final Deployment**
   - Deploy the model in a real-time environment (e.g., web service or cloud platform).
   - Ensure that the deployed model can take real-time inputs and classify them efficiently.

Reference Code and Resources:
Here are some sample codebases and APIs that you can take reference from while implementing the model:

1. **Multimodal Fake News Detection**: https://github.com/faiazrahman/Multimodal-Fake-News-Detection
2. **Multimodal Fake News Detection with Attention Mechanism**: https://github.com/PPEXCEPED/TGA
3. **RoBERTa-based Fake News Classification**: https://huggingface.co/hamzab/roberta-fake-news-classification