Tool Action Recognition using TCN and LSTM Models

1. Dataset Usage

We will use the **Tool Tracking dataset** for this project. Specifically, we intend to use the temporal data capturing the motion and usage patterns of tools over time. The dataset includes sequences of tool movements corresponding to different labeled actions performed by three distinct tools.

2. Task Description

Our primary task is **tool action recognition** based on the temporal behaviour of tool movements. Each input sample consists of a time-series sequence representing a tool's action, and the objective is to classify this sequence into one of several predefined action categories.

3. Baseline Models

In line with the supervisor's suggestions, we will implement and compare the following baseline models:

- Temporal Convolutional Network (TCN) with Early Fusion
- Temporal Convolutional Network (TCN) with Late Fusion
- Long Short-Term Memory (LSTM)

4. Advanced Method

For our advanced approach, we will explore **semi-supervised learning** by varying the proportion of labeled and unlabeled data. This will help us understand the impact of limited supervision on model performance. For each of the baseline models (TCN with Early Fusion, TCN with Late Fusion, and LSTM), we will conduct the following experiments:

1. Train with 100% labelled data.
2. Train with 25% labelled data only.
3. Train with 25% labeled + 75% unlabeled data

This setup will help us evaluate how effectively semi-supervised learning can leverage unlabeled data to improve action recognition performance in scenarios with limited labeled data.

5. Task Distribution

The tentative work distribution among group members is as follows:

- Monika Chavan: Implementation of TCN with Early Fusion.
- Apoorva: Implementation of TCN with Late Fusion.
- Shashank: Implementation of LSTM model.
- Taimoor Hussain: Integration of supervised and semi-supervised variants across all models.

All Members: Data preprocessing, evaluation, result aggregation, report writing, and final presentation.