**PSEUDO CODE:**

1.Dataset Details:

• Collecting different datasets like Deepfake detection challenge(DFDC) and Celeb-DF.

2. Initialization and Imports:

• Import required libraries torch, torchvision, os, numpy, cv2, matplotlib, face\_recognition, json, pandas, copy, glob, random, sklearn.

3. Data Preprocessing :

• Using glob we imported all the videos in the directory in a python list.

• cv2.VideoCapture is used to read the videos and get the mean number of frames in each video.

• To maintain uniformity, based on mean a value 150 is selected as idea value for creating the new dataset.

• The video is split into frames and the frames are cropped on face location.

• The face cropped frames are again return to new video file that is face\_only\_data using VideoWriter.

• The new video is written at 30 frames per second and with the resolution of 112 x 112 pixels in the mp4 format.

• Instead of selecting the random videos, to make the proper use of LSTM for temporal sequence analysis the first 150 frames are written to the new video

4.Model Training:

• Train Test Split:The dataset is split into train and test dataset with a ratio of 70% train videos (98) and 30% (42) test videos.

• Data Loader: It is used to load the videos and their labels with a batch size of 4

• Training: The training is done for 20 epochs with a learning rate of 1e-5 (0.00001), weight decay of 1e-3 (0.001) using the Adam optimizer

• Adam optimizer: To enable the adaptive learning rate Adam optimizer with the model parameters is used.

• Cross Entropy: To calculate the loss function Cross Entropy approach is used because we are training a classification problem.

• Softmax Layer: A Softmax function is a type of squashing function. Squashing functions limit the output of the function into the range 0 to 1 i.e REAL or FAKE, also Softmax layer provide us the confidence (probability) of prediction.

• Confusion Matrix: A confusion matrix is a summary of prediction results on a classification problem. The number of correct and incorrect predictions are summarized with count values and broken down by each class. This is the key to the confusion matrix.

• Export Model: After the model is trained, we have exported the model. So that it can be used for prediction on real time data.

5. Model Prediction Details:

• The new video for prediction is preprocessed and passed to the loaded model for prediction

• The trained model performs the prediction and return if the video is a real or fake along with the confidence of the prediction.

**FORMULAS:**

*CROSS-ENTROPY LOSS:*

**• Cross-Entropy Loss = −(*y*⋅log(*p*)+(1−*y*)⋅log(1−*p*))**

Where:

• Y is the true label (0 for REAL and 1 for FAKE)

• P is the predicted probability of the positive class (i.e, “FAKE”).

*Adam:*

Let:

* t be the time step
* α be the learning rate.
* β1 and β2 be the exponential decay for the first and second moments of the gradient, respectively
* **MEAN OF GRADIENTS : *mt*​=*β*1​⋅*mt*−1​+(1−*β*1​).gt**

*Softmax function:*

• **softmax(*z)***

*Relu activation function:*

***f*(*x*)=max(0,*x*)**

where:

• f(x) is the output of the ReLU function for input x

• x is the input value