

# Deep Fake Video Detection using Deep Learning, Res-Next and LSTM

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**Abstract**— In recent months, free deep learning-based software tools has facilitated the creation of credible face exchanges in videos that leave few traces of manipulation, in what they are known as "Deepfake"(DF) videos. Manipulations of digital videos have been demonstrated for several decades through the good use of visual effects, recent advances in deep learning have led to a drastic increase in the realism of fake content and the accessibility in which it can be created. These so-called AI-synthesized media (popularly referred to as DF). Creating the DF using the Artificially intelligent tools are simple task. But, when it comes to detection of these DF, it is major challenge. Because training the algorithm to spot the DF is not simple. We have taken a step forward in detecting the DF using Convolutional Neural Network and Recurrent neural Network. System uses a convolutional Neural network (CNN) to extract features at the frame level. These features are used to train a recurrent neural network (RNN) which learns declassify video has been subject to manipulation or not and able to detect the temporal inconsistencies between frames introduced by the DF creation tools. Expected result against a large set of fake videos collected from standard data set. We show how our system can be competitive result in this task results in using a simple architecture.

**Keywords:** Deepfake Video Detection, convolutional Neural network (CNN), recurrent neural network (RNN)

## I. INTRODUCTION

1.The increasing sophistication of smartphone cameras and the availability of good internet connection all over the world has increased the ever-growing reach of social media and media sharing portals have made the creation and transmission of digital videos easier than ever before. The growing computational power has made deep learning so powerful that would have been thought impossible only a handful of years ago. Like any transformative technology, this has created new challenges. So-called "Deepfake" produced by deep generative adversarial models that can manipulate video and audio clips. Spreading of the DF over the social media platforms have become very common Leading to spamming and peddling wrong information over the platform. These types of the DF will be terrible, and lead to threatening, misleading of common people.

2.To overcome such a situation, DF detection is very important. So, we describe a new deep learning-based method that can effectively distinguish AI-generated fake videos (DF Videos) from real videos. It's incredibly important to develop technology that can spot fakes, so that the DF can be identified and prevented from spreading over the internet.

3.For detection the DF it is very important to understand the way Generative Adversarial Network (GAN) creates the DF.GAN takes as input a video inanimate specific individual ('target'), and outputs another video with the target's faces replaced with those of another individual ('source'). The backbone of DF are deep adversarial neural networks trained on face images and target videos to automatically map the faces and facial expressions of the source to the target. With proper post- processing, the resulting videos can achieve a high level of realism. The GAN split the video into frames and replaces the input image in every frame. Further it reconstructs the video. This process is usually achieved by using autoencoders. We describe a new deep learning-based method that can effectively distinguish DF videos from the real ones. Our method is based same process that is used to create the DF by GAN[1-27].

4.The method is based on a property of the DF videos, due to limitation of computation resources and production time, the DF algorithm can only synthesize face images of a fixed size, and they must undergo an affinal warping to match the configuration of the source's face. This warping leaves some distinguishable artifacts in the output deepfake video due to the resolution inconsistency between warped face area and surrounding context. Our method detects such artifacts by comparing the generated face areas and their surrounding regions by splitting the video in to frames and extracting the features with a Res Next Convolutional Neural Network (CNN) and using the Recurrent Neural Network (RNN) with Long Short-Term Memory (LSTM) capture the temporal inconsistencies between frames introduced by GAN during the reconstruction of the DF. To train the Res Next CNN model, we simplify the process by simulating the resolution inconsistency in affine face wrappings directly[1-27]

## II. LITERATURE SURVEY

The explosive growth in deep fake video and its illegal use is a major threat to democracy, justice, and public trust. Due to this there is a increased the demand for fake video analysis, detection and intervention. Some of the related word in deep fake detection are listed below:

1.Exposing Videos by Detecting Face Warping Artifacts used an approach to detects artifacts by comparing the generated face areas and their surrounding regions with a dedicated Convolutional Neural Network model. In this work there were two-fold of

Face Artifacts. Their method is based on the observations that current DF algorithm can only generate images of limited resolutions, which are then needed to be further transformed to match the faces to be replaced in the source video. (Deng Pan, Lixian Sun, 2020).

2. Exposing AI-Created Fake Videos by Detecting Eye Blinking describes a new method to expose fake face videos generated with deep neural network models. The method is based on the detection of eye blinking in the videos, which is a physiological signal that is not well presented in the synthesized fake videos. The method is evaluated over benchmarks of eye-blinking detection datasets and shows promising performance on detecting videos generated with Deep Neural Network based software DF. Their method only uses the lack of blinking as a clue for detection. However, certain other parameters must be considered for detection of the deep fake like teeth enchantment, wrinkles on faces etc. Our method is proposed to consider all these parameters. (Asad Malik, 2022)

3. Using capsule networks to detect forged images and videos uses a method that uses a capsule network to detect forged, manipulated images and videos in different scenarios, like replay attack detection and computer-generated video detection. In their method, they have used random noise in the training phase which is not a good option. Still, the model performed beneficial in their dataset but may fail on real-time data due to noise in training. Our method is proposed to be trained on noiseless and real-time datasets. (Shobha Rani B R, Piyush Kumar Pareek, 2023).

4. Detection of Synthetic Portrait Videos using Biological Signals approach extracts biological signals from facial regions on authentic and fake portrait video pairs. Apply transformations to compute the spatial coherence and temporal consistency, capture the signal characteristics in feature sets and PPG maps, and train a probabilistic SVM and a CNN. Then, the aggregate authenticity probabilities to decide whether the video is fake or authentic. Fake Catcher detects fake content with high accuracy, independent of the generator, content, resolution, and quality of the video. Due to lack of discriminator leading to the loss in their findings to preserve biological signals, formulating a differentiable loss function that follows the proposed signal processing steps is not straightforward. (Sarra Guefrachi, 2025)

#### **Problem Statement:**

Develop a machine learning-based approach to detect deepfake videos by analyzing facial features, motion inconsistencies, and other video artifacts. The model should effectively classify videos as either real or fake using deep learning techniques such as Convolutional Neural Networks (CNNs).

### III. PROPOSED SYSTEM

There are many tools available for creating the DF, but for DF detection, there is hardly any tool available. Our approach for detecting the DF will be a great contribution in avoiding the percolation of the DF over the worldwide web. We will be providing a web-based platform for the user to upload the video and classify it as fake or real. This project can be scaled up from developing a web-based platform to a browser plugin for automatic DF detection. Even big applications like WhatsApp and Facebook can integrate this project with their application for easy pre-detection of DF before sending it to another user. One of the important objectives is to evaluate its performance and acceptability in terms of security, user-friendliness, accuracy, and reliability. Our method is focusing on detecting all types of DF like replacement DF, retrenchment DF and interpersonal DF. figure.1 represents the simple system architecture of the proposed system: -

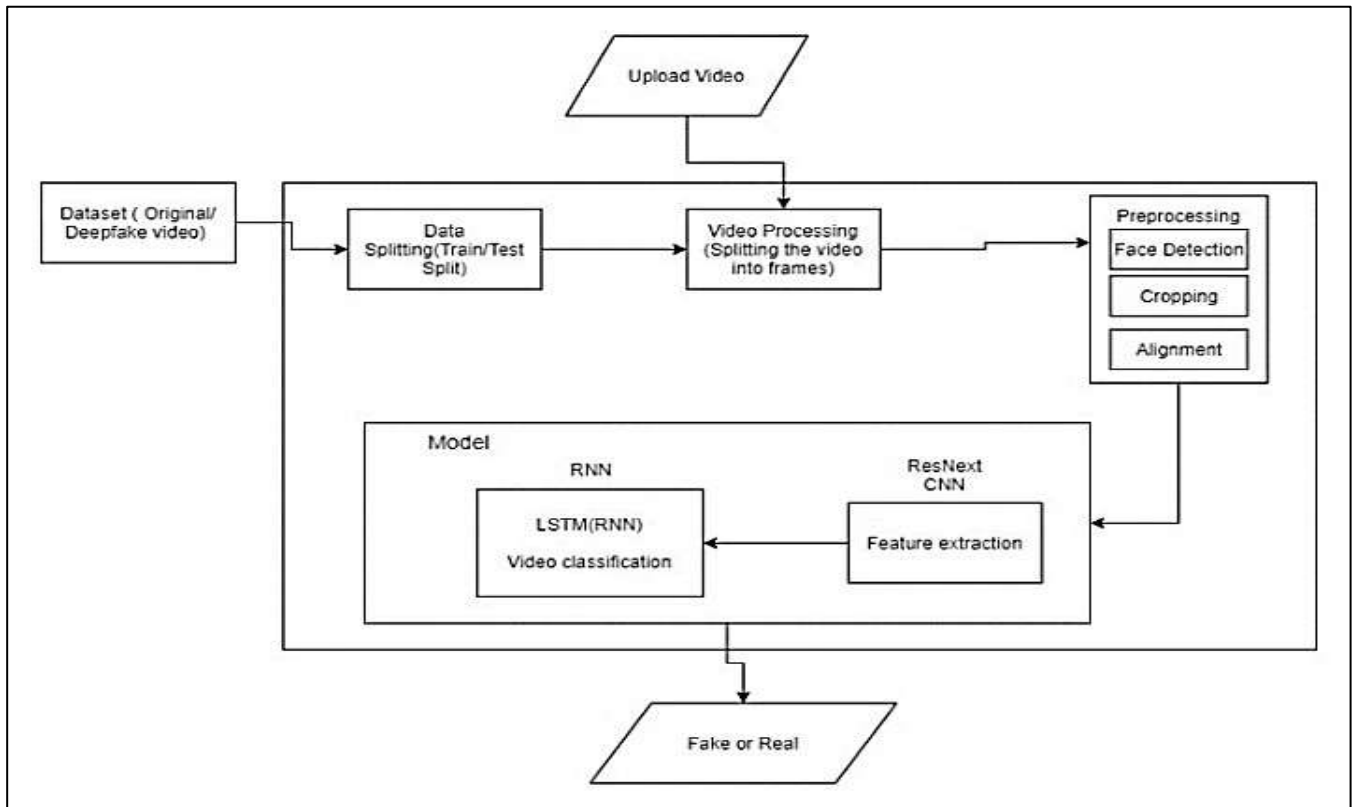


Fig.1: SystemArchitecture

#### A. Dataset:

We are using a mixed dataset that consists of an equal amount of videos from different sources like YouTube, Face Forensics++ [14], and the Deepfake Detection Challenge dataset [13]. Our newly prepared dataset contains 50% original videos and 50% manipulated deepfake videos. The dataset is split into 70% training and 30% testing sets.

#### B. Preprocessing:

Dataset preprocessing includes splitting the video into frames, followed by face detection and cropping the frame with the detected face. To maintain uniformity in the number of frames, the mean of the dataset video is calculated, and a new processed face-cropped dataset is created containing frames equal to the mean. Frames that do not contain faces are ignored during preprocessing.

Processing a 10-second video at 30 frames per second (i.e., a total of 300 frames) requires significant computational power. For experimental purposes, we propose using only the first 100 frames for training the model.

#### C. Model:

The model consists of **ResNext50\_32x4d** followed by one **LSTM** layer. The Data Loader loads the pre-processed face-cropped videos and splits them into training and testing sets. Further, frames from the processed videos are passed to the model for training and testing in mini-batches.

#### D. ResNext CNN for Feature Extraction:

Instead of rewriting the classifier, we propose using the **ResNext CNN classifier** for extracting features and accurately

detecting frame-level features. We will fine-tune the network by adding extra required layers and selecting an appropriate learning rate to ensure proper convergence of the gradient descent. The **2048-dimensional feature vectors** from the last pooling layer are then used as the sequential LSTM input.

### E. LSTM for Sequence Processing:

Let us assume a sequence of **ResNext CNN feature vectors** from input frames as input and a **2-node neural network** that outputs the probabilities of the sequence being part of a deepfake video or an untampered video. The key challenge we need to address is the design of a model to recursively process a sequence in a meaningful manner.

### F. Predict:

A new video is passed to the trained model for prediction. The new video is also pre-processed to match the format of the trained model. The video is split into frames, followed by face cropping. Instead of storing the video in local storage, the cropped frames are directly passed to the trained model for detection.

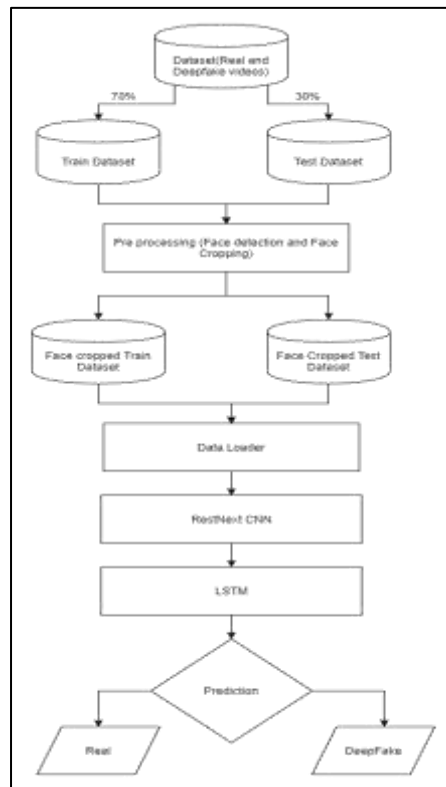


Fig.2: Training Flow  
IV. RESULT

The output of the model is going to be whether the video is deepfake or a real video along with the confidence of the model. One example is shown in the figure 3.



Fig.3: Prediction flow

#### V. CONCLUSION

We presented a neural network-based approach to classify a video as deepfake or real, along with the confidence score of the proposed model. The proposed method is inspired by the way deepfakes are created using GANs with the help of Autoencoders. Our method performs frame-level detection using **ResNext CNN** and video classification using **RNN along with LSTM**. The proposed method is capable of detecting whether a video is deepfake or real based on the parameters listed in the paper. We believe that it will provide very high accuracy on real-time data.

#### VI. LIMITATIONS

Our method does not consider audio, which means it will not be able to detect **audio deepfakes**. However, we propose achieving the detection of audio deepfakes in the future.

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