# SAVITRIBAI PHULE PUNE UNIVERSITY

## ACTIVITY BOOK FOR

## “DeepFake Detection Machine Learning ”

***Submitted to the Department of Artificial intelligence and machine learning Engineering, SVCET, Rajuri, Pune, in partial fulfillment of the requirements for the***

**FINAL YEAR OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**Group Id : 005**


## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING ENGINEERING

**SAHYADRI VALLEY COLLEGE OF ENGINEERING & TECHNOLOGY, RAJURI, PUNE (2024-2025)**

# Title Page

1. **Name of Student** : Jadhav Abhijeet Digambar
   Lokare Sakshi Pandurang
   Sinde Priya Ravindra

2. **Branch** : Artificial intelligence and machine learning Engineering

3. **Academic Year** : 2024-25

4. **Activity Book** : 16/01/2025 – 12/03/2025

5. **Proposed Topic** : DeepFake Detection Using Machine Learning

……

… **Day & Date : Thursday 16/01/2025**

Day 1

**Work Done**: Finalized the project topic. Conducted initial research on deepfake threats and machine learning techniques.

**Tools Used**: Research papers, browser, Google Scholar

**Learnings**: Understood different approaches to deepfake detection.

**Challenges**: Narrowing down the exact ML method.

**Next Steps**: Start dataset collection and tool selection.

……

… **Day & Date : Friday 17/01/2025**

Day 2

**Work Done**: Selected the FaceForensics++ dataset. Set up project repo and virtual environment.

**Tools Used**: GitHub, Python, pip, Anaconda

**Learnings**: How to structure ML project files.

**Challenges**: Dataset size and storage.

**Next Steps**: Preprocess the dataset.

……

… **Day & Date : Wednesday 22/01/2025**

Day 3

**Work Done**: Wrote preprocessing scripts to resize, normalize frames, and label real/fake videos.

**Tools Used**: OpenCV, NumPy, Pandas

**Learnings**: Handling video-to-frame conversion.

**Challenges**: Time taken to process large datasets.

**Next Steps**: Build CNN model for feature extraction.

……

… **Day & Date : Thursday 23/01/2025**

Day 4

**Work Done**: Implemented ResNeXt CNN architecture for spatial feature extraction.

**Tools Used**: PyTorc

**Learnings**: Deep residual networks for image classification.

**Challenges**: GPU memory overflow.

**Next Steps**: Train the CNN and evaluate.

……

…**Day & Date : Friday 24/01/2025**

Day 5

**Work Done**: Trained CNN on real vs fake image frames. Achieved baseline accuracy.

**Tools Used**: PyTorch, TensorBoard

**Learnings**: How CNN learns low-level image manipulations.

**Challenges**: Overfitting noticed after 5 epochs.

**Next Steps**: Add temporal learning using LSTM..

……

… **Day & Date : Wednesday 29/01/2025**

Day 6

**Work Done**: Integrated CNN + LSTM model to learn spatiotemporal patterns.

**Tools Used**: PyTorch, torch.nn.LSTM

**Learnings**: Sequence modeling with video frames.

**Challenges**: Adjusting input dimensions between CNN output and LSTM input.

**Next Steps**: Train combined model.

……

… **Day & Date : Thursday 30/01/2025**

Day 7

**Work Done**: Trained CNN+LSTM architecture and evaluated accuracy.

**Tools Used**: GPU (Google Colab), PyTorch

**Learnings**: Joint spatial-temporal learning improves results.

**Challenges**: Runtime instability on long videos.

**Next Steps**: Optimize model and hyperparameters.

……

… **Day & Date : Friday 31/01/2025**

Day 8

**Work Done**: Applied dropout, learning rate decay, and batch normalization.

**Tools Used**: PyTorch optimizer, torch.nn modules

**Learnings**: Improved generalization with regularization.

**Challenges**: Finding optimal dropout rate.

**Next Steps**: Build Django-based front-end for testing.

……

…**Day & Date : Wednesday 05/02/2025**

Day 9

**Work Done**: Created Django project to upload and analyze videos.

**Tools Used**: Django, HTML, Bootstrap

**Learnings**: Backend-server integration with ML model.

**Challenges**: Large video upload handling.

**Next Steps**: Connect frontend to prediction pipeline.

……

… **Day & Date : Thursday 06/02/2025**

Day 10

**Work Done**: Integrated PyTorch model with Django backend using REST APIs.

**Tools Used**: Django REST Framework

**Learnings**: ML inference as a web service.

**Challenges**: Prediction delays due to frame-by-frame processing.

**Next Steps**: Optimize video sampling.

……

…**Day & Date : Friday 07/02/2025**

Day 11

**Work Done**: Implemented sampling logic to reduce number of frames per video.

**Tools Used**: OpenCV

**Learnings**: Balanced speed and accuracy with fewer frames.

**Challenges**: Choosing ideal frame sampling rate.

**Next Steps**: Test model with real-world deepfakes.

……

… **Day & Date : Wednesday 12/02/2025**

Day 12

**Work Done**: Collected and tested videos from YouTube and TikTok.

**Tools Used**: YoutubeDL, Browser

**Learnings**: Deepfakes vary significantly in manipulation quality.

**Challenges**: Inconsistent video formats.

**Next Steps**: Validate model across diverse samples

……

…**Day & Date : Thursday 13/02/2025**

Day 13

**Work Done**: Visualized LSTM activations for interpretability.

**Tools Used**: Matplotlib, seaborn

**Learnings**: Identified which features help in detecting deepfakes.

**Challenges**: Complexity in interpreting high-dimensional data.

**Next Steps**: Add Grad-CAM for visual insights.

……

… **Day & Date : Friday 14/02/2025**

Day 14

**Work Done**: Implemented Grad-CAM to highlight manipulated video regions.

**Tools Used**: PyTorch hooks, OpenCV

**Learnings**: Saliency maps for explainability.

**Challenges**: Generating consistent overlays.

**Next Steps**: Add user option to display these in GUI.

……

…**Day & Date : Wednesday 19/02/2025**

Day 15

**Work Done**: Integrated saliency map output into frontend.

**Tools Used**: Django Templates

**Learnings**: Improved user interaction and trust in results.

**Challenges**: Image overlay mismatches.

**Next Steps**: Create download report feature.

……

… **Day & Date : Thursday 20/02/2025**

Day 16

**Work Done**: Developed report generator for prediction results.

**Tools Used**: ReportLab

**Learnings**: Auto-generating PDFs from model outputs.

**Challenges**: Formatting report structure.

**Next Steps**: Deploy on cloud for testing.

……

… **Day & Date : Friday 21/02/2025**

Day 17

**Work Done**: Deployed application on Heroku using Docker.

**Tools Used**: Docker, Heroku CLI.

**Learnings**: Cloud deployment of ML-powered web apps.

**Challenges**: Memory allocation and slug size.

**Next Steps**: Monitor logs and latency.

……

… **Day & Date : Wednesday 26/02/2025**

Day 18

**Work Done**: Collected logs, latency data, and user feedback.

**Tools Used**: Heroku Dashboard

**Learnings**: Importance of performance monitoring.

**Challenges**: Occasional timeouts.

**Next Steps**: Optimize video processing pipeline.

……

…**Day & Date : Thursday 27/02/2025**

Day 19

**Work Done**: Cleaned up project files, added inline comments.

**Tools Used**: VS Code

**Learnings**: Importance of clean code and documentation.

**Challenges**: Commenting all scripts thoroughly.

**Next Steps**: Create flowchart and architecture diagram.

……

… **Day & Date : Friday 28/02/2025**

Day 20

**Work Done**: Created flowchart and system architecture diagram.

**Tools Used**: Draw.io

**Learnings**: Documenting system pipelines visually.

**Challenges**: Making diagrams informative yet minimal.

**Next Steps**: Start drafting final report.

……

… **Day & Date : Wednesday 05/03/2025**

Day 21

**Work Done**: Drafted project report with screenshots, charts, and results.

**Tools Used**: MS Word

**Learnings**: Reporting technical concepts clearly.

**Challenges**: Screenshot formatting.

**Next Steps**: Add abstract, conclusion, and references.

……

… **Day & Date : Thursday 06/03/2025**

Day 22

**Work Done**: Completed report and added conclusion, limitations, and future scope.

**Tools Used**: MS Word

**Learnings**: Reporting best practices.

**Challenges**: Time management.

**Next Steps**: Create presentation

……

…**Day & Date : Friday 07/03/2025**

Day 23

**Work Done**: Created PowerPoint for project demonstration.

**Tools Used**: MS PowerPoint

**Learnings**: How to communicate findings to evaluators.

**Challenges**: Compressing 2 months of work into 10 slides.

**Next Steps**: Final demo preparation.

……

… **Day & Date : Wednesday 12/03/2025**

## Day 24

**Work Done**: Conducted project dry-run, tested app, fixed UI issues, and completed submission.

**Tools Used**: Django, PowerPoint

**Learnings**: How to carry a project from idea to deployment.

**Challenges**: Minor code bugs and formatting fixes.

**Next Steps**: Submit and present project.