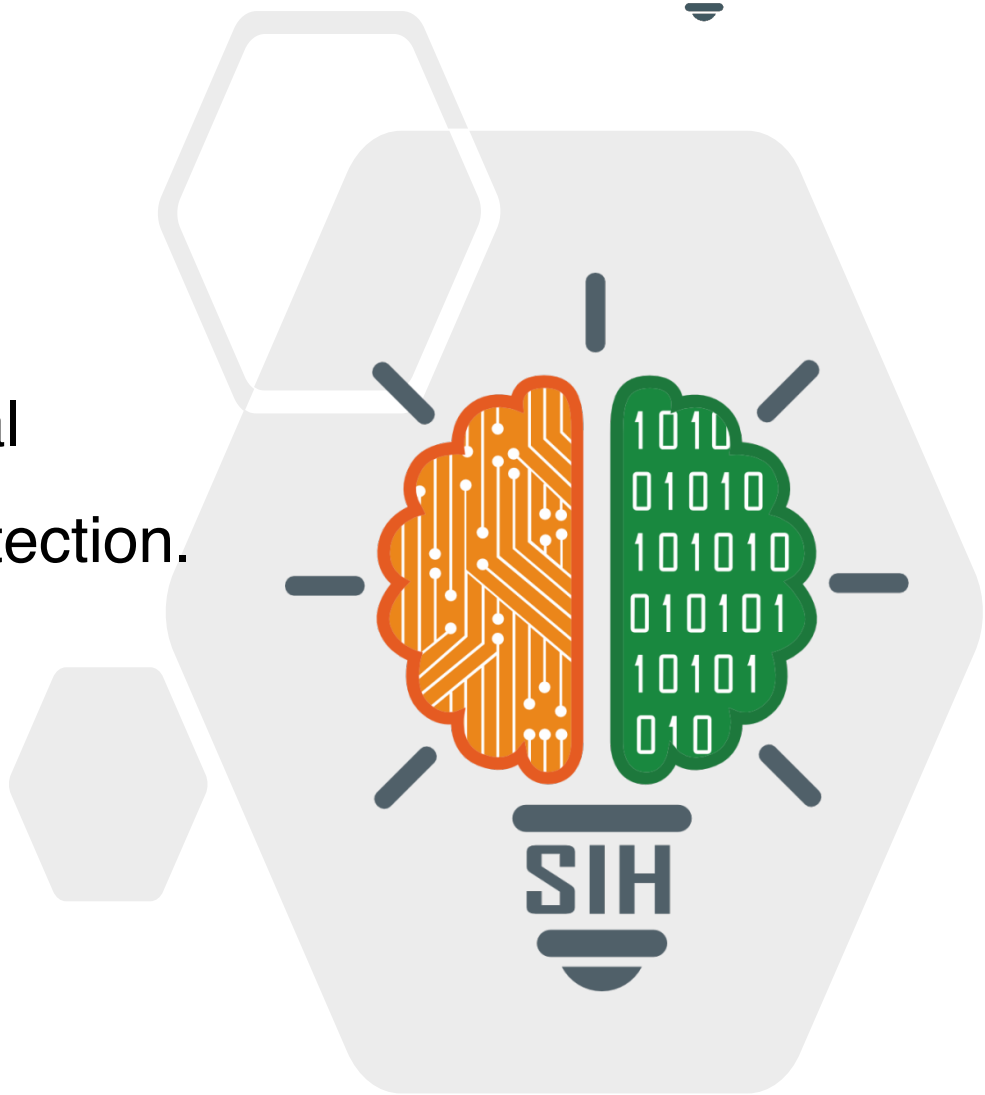
SMART INDIA HACKATHON 2024

TITLE PAGE

- **Problem Statement ID –** 1671
- **Problem Statement Title-** Develop a functional solution that demonstrates the face liveness detection.
- **Theme-** Smart Automation
- **PS Category-** Software
- **Team ID-**
- **Team Name-** Code Crushers



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FACE LIVENESS DETECTION

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❖ Proposed Solution:

A deep-learning pipeline capable of spotting fake vs legitimate faces and performing anti-face spoofing in face recognition systems. It is built with the help of keras, Tensorflow, and OpenCV.

❖ Addressing the Problem:

Challenge: High-quality spoofing techniques, such as deepfakes and high-resolution masks, make it difficult to distinguish between real and fake faces.

Solution: Combine pre-trained models with custom neural network layers and temporal dynamics to detect subtle discrepancies. Feature extraction and a tailored classification head help the model learn nuanced liveness indicators.

❖ Innovation and Uniqueness:

Explainable AI: Implementing explainability techniques enhances the trustworthiness of the model by providing insights into its decision-making process.

Multi-Modal Integration: Leveraging both deep learning and texture-based methods improves robustness against various spoofing techniques.

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TECHNICAL APPROACH

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- It is built with the help of Keras, Tensorflow, and OpenCV.
- **Sample_liveness_data:** contains the sample dataset.
- **Deploy.prototxt:** Support file for pre-trained face detector.
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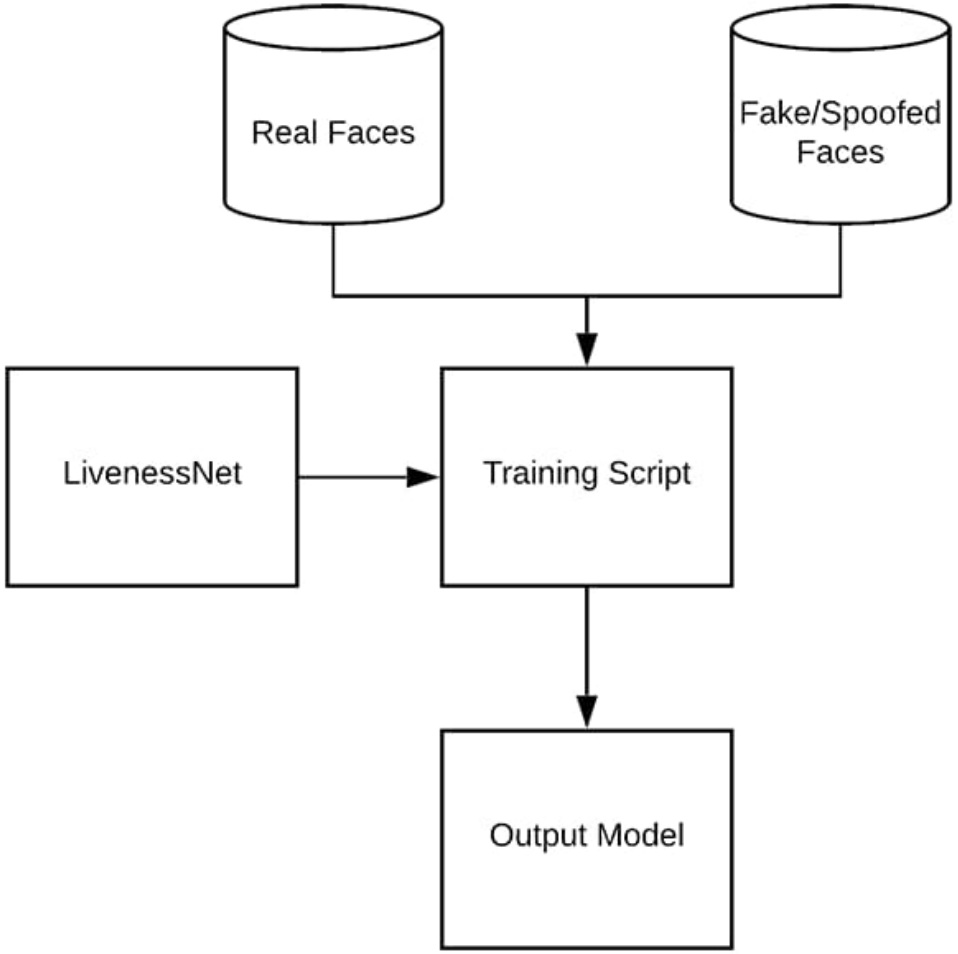
- **Es10_300x300_ssd_iter_140000.caffemodel:** Pre-trained face detector.
- **Train_liveness.py:** The python script to train the model.
- **Optical Flow Analysis:** For capturing motion dynamics in video sequences.



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FEASIBILITY AND VIABILITY

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❖ Feasibility Analysis:

The feasibility of a deep-learning pipeline for detecting fake faces is high due to advances in technology and available datasets. Challenges include handling diverse spoofing techniques and ensuring real-time accuracy. Success depends on robust training and adaptability to new spoofing methods.

❖ Potential Challenges:

Potential challenges include managing the diversity of spoofing methods and ensuring the system performs well in real-time scenarios. Risks involve overfitting to specific spoofing techniques and the potential for adversarial attacks that could bypass detection.

❖ Overcoming Challenges:

To overcome these challenges, use a diverse and extensive dataset that includes a wide range of spoofing techniques to ensure robust training. Implement regularisation techniques and cross-validation to prevent overfitting. Incorporate real-time testing and iterative updates to adapt to emerging spoofing methods.

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IMPACT AND BENEFITS

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- **Impact on Environment:** Efficient deep-learning algorithms can reduce computational resource requirements and energy consumption, contributing to lower carbon footprints for data centers.

- **Benefits to Mankind:** By improving face recognition security, the project helps protect personal identity and sensitive information, reducing fraud and enhancing safety in various applications.

- **Day-to-Day Life:** The technology ensures more reliable and secure access controls, such as unlocking devices or authorising transactions, and boosts user confidence in digital interactions by minimising the risk of identity theft.

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RESEARCH AND REFERENCES

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❖ Existing solutions and case studies:

~ Samsung’s Face Recognition for Mobile Devices.
~ Microsoft Azure Face API.
~ University of Oxford's Liveness Detection System.

❖ Privacy and Compliance considerations:

~ "Privacy-Preserving Face Recognition Using Deep Learning Techniques" by E. A.T. Lee et al..
~ "Adversarial Attacks and Privacy Concerns in Face Recognition Systems" by S. Shum et al.