ENS – IISER Network / BIOSANTEXC Project

Internship Proposal Form
France to India

(Discipline/Field name)
School of Data Science

Internship title: Development of an Advanced Driver Monitoring System Using Deep Learning Techniques

Keywords related with the subject (minimum 3): Driver monitoring system (DMS), Deep Learning, Convolutional Neural Networks (CNNs), Driver Drowsiness Detection, Driver Distraction Detection, Computer Vision, Automotive Industry, Road Safety

Name of the IISER: Indian Institute of Science Education and Research Thiruvananthapuram (IISER TVM)

Name of the laboratory(ies): Deep Intelligence Learning Lab (DiL Lab)

Name of the internship supervisor(s): Dr. Alwin Poulose

Email(s): alwinpoulosepalatty@iisertvm.ac.in

Prerequisites for the internship: Basic understanding of machine learning and deep learning models, Python, Image/signal processing techniques

Requested level: Masters/PhD level

Foreseen internship dates: December ~ May

Internship type (refer to page 1):

√ 3–6-month internship ☐ Research stays ☐ 6+6 months internship

For 3 to 6 months internships, please indicate the desired duration: 6 months

For 6+6 months internships, please also fill in:

- **Name of the internship co-supervisor:**
- **Name of the co-supervisor's laboratory/entity:**
- **Email of the co-supervisor:**

Internship proposal (description and expected training outcomes / half page min, 1 page max):

Internship Objective: To design and implement a Driver Monitoring System (DMS) that utilizes deep learning models to detect driver drowsiness, distraction, and other potentially dangerous behaviors. The system aims to enhance road safety by providing timely alerts to prevent accidents.

Background: With the increasing number of vehicles on the road, driver safety has become a critical concern. Many road accidents are caused by driver fatigue, distraction, and other human factors. A DMS that can detect and alert drivers of potential risks in real-time could significantly reduce accident rates. Recent advancements in deep learning have made it possible to analyze and interpret complex visual data, making it feasible to develop such a system.

Scope of Work:

Literature Review:

Conduct a comprehensive review of existing Driver Monitoring Systems. Study the application of deep learning models in real-time monitoring and image/video analysis. Explore state-of-the-art techniques in facial recognition, emotion detection, and gaze estimation.

Data Collection and Preprocessing:

Collect or utilize existing datasets of driver behavior, including facial expressions, head pose, and eye movement. Preprocess the data to enhance the quality of input for deep learning models, including normalization, augmentation, and noise reduction techniques.

Model Development:

Implement various deep learning models, such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and attention-based models, for detecting driver states. Experiment with different architectures and hyperparameters to optimize performance.

Performance Evaluation:

Using standard metrics, evaluate the system's accuracy, speed, and reliability. Conduct tests in simulated and real-world driving scenarios to validate the system's effectiveness.

Documentation and Reporting:

Document the development process, including model architectures, hyperparameters, and evaluation results. Prepare a final report summarizing the outcomes of the internship, along with recommendations for future improvements.

Recent Publication: https://www.sciencedirect.com/science/article/abs/pii/S0010482524010308

Expected Outcomes:

A functioning prototype of a Driver Monitoring System that can detect and alert against driver drowsiness, distraction, and other unsafe behaviors. A comprehensive report detailing the system's design, development, and performance evaluation.

Skills and Tools: Proficiency in Python and deep learning frameworks such as TensorFlow or PyTorch, Experience with computer vision techniques and tools like OpenCV, Knowledge of real-time data processing and video analysis, Familiarity with model evaluation metrics and techniques.

Timeline:

- Month 1-2: Literature review and data collection.
- Month 3-4: Model development and experimentation.
- Month 5-6: Performance evaluation and final reporting.