Students' Placement Office, IIT Kanpur

Project Verification Form

Title of the Project	A Statistical Similarity Measure for Aggregate Crowd Dynamics
Commencement Date	05-05-2024
Completion Date	12-07-2024
Project Supervisor	Prof. Shankar Prawesh
Organization/Institution where the Project was accomplished	Indian Institute Of Technology Kanpur

Project Description (You can use extra A4 sheets in case you run out of space however the extra sheets should also have the seal & signature of the Project Supervisor or the relevant authority)

Objective:

• To develop comprehensive crowd simulation models to accurately simulate and predict pedestrian dynamics, enhance urban safety and optimize crowd management

Approach:

1) **Data Collection and Preprocessing:** Utilized YOLOv8n for tracking pedestrian movements in video footage with detection accuracy of 92%. Extracted positional and velocity data to create a comprehensive dataset for simulation.

2) **Ensemble Kalman Smoothing (EnKS):** Utilized EnKS to estimate and refine pedestrian state distributions, improving the tracking accuracy by 15%.

3) **Model Implementation:**

(i) **Steering Model:** Implemented the Steering Model to guide pedestrian movements based on a set of behavioral rules and forces.

(ii) **Social Force Model:** Simulated realistic pedestrian interactions and movements based on social forces, considering factors like personal space and social interactions.

(iii) **Predictive Planning Model:** Applied Reciprocal Velocity Obstacle (RVO) for collision avoidance and optimal path planning, using linear programming to compute optimal velocities for agents.

4) **Validating Model Accuracy:** Calculated metrics such as entropy, error mean, & error standard deviation using Maximum Likelihood Estimation to evaluate model performance.

5) **Data Visualization:** Generated and validated model accuracy by creating a video of simulated pedestrian trajectories obtained from three models using OpenCV library.

Results:

1) **Entropy scores:**

(i) Steering Model: 4.46

(ii) Social Force Model: 5.06

(iii) Predictive Planning Model: 5.96

2) Optimized the simulation for real-time applications, providing insights into crowd dynamics & potential safety issues.

By appending your signatures to this form you acknowledge and agree that:

- This form along with the certificate would serve as the official document between the project supervisor and Students Placement Office, IIT Kanpur regarding verification of the student's project work
- The student will provide additional information and documentation relevant to his/her project upon request by the Students' Placement Office
- The student has clearly defined his/her individual role in projects done in cooperation with other students, faculty, groups or company personnel.
- Incorrectly over-stating the reach, impact and/or quantitative/qualitative results of a project is unethical.
- In case of violation of any of the above rules, Students' Placement Office, IIT Kanpur reserves the right to take necessary action including de-registering the student from the placement season and reporting the misconduct to the Institute Authorities.

Submitted by:-	**Project Supervisor Details:-**
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