

# Enhancing Safety Analysis Through Microscopic Traffic Modeling



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## Contribution & Motivation

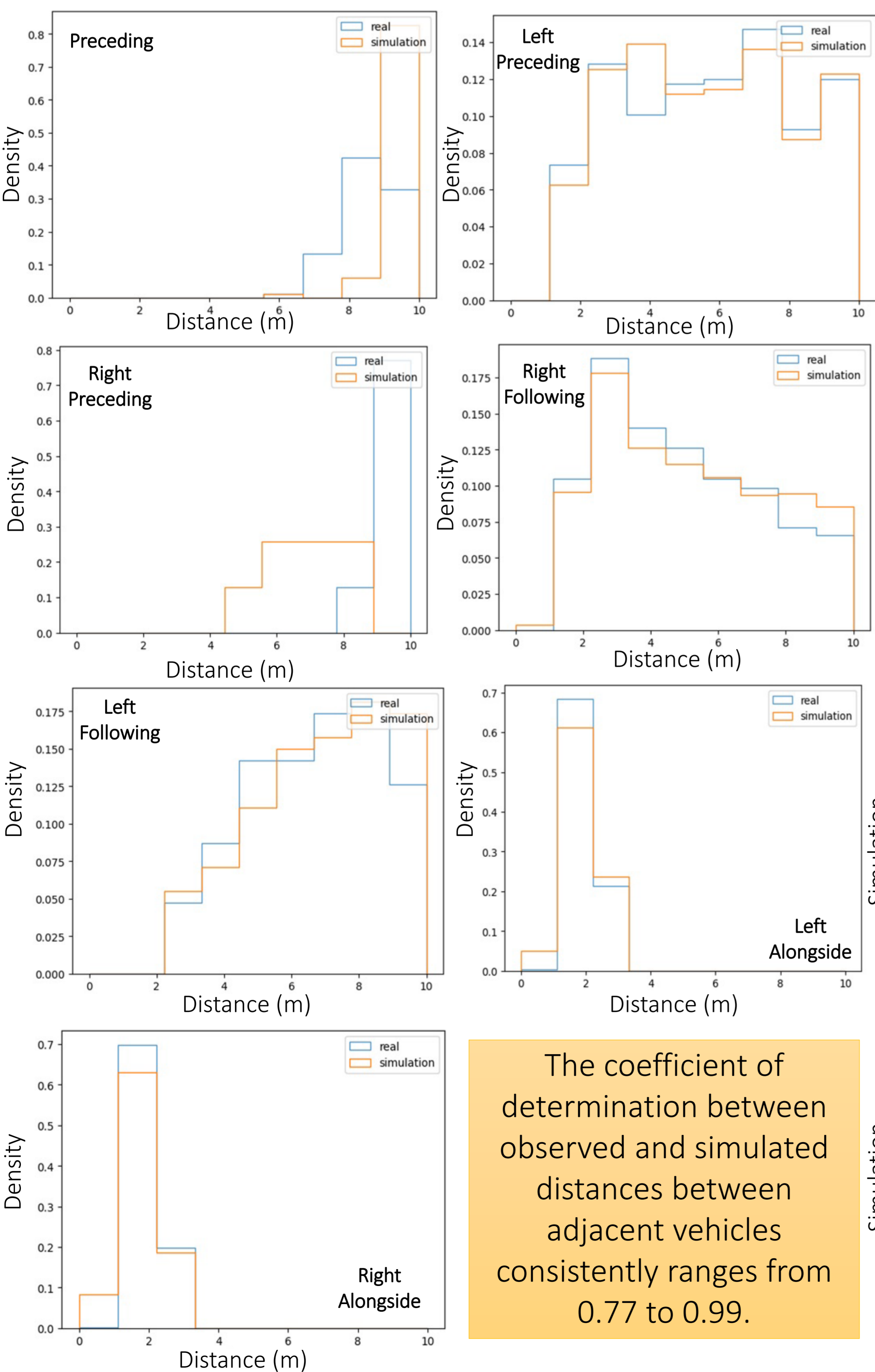
- ✓ Possibility of using microsimulation models to predict potential crashes by defining non collision-free car following model (CFM) and lane changing model (LCM)
- ✓ Simulate vehicle movements at a microscopic level, ensuring that the distances between adjacent vehicles closely mirror real-world conditions
- ✓ Adopt a two-step calibration approach involving a fast and an iterative calibration process to find the parameters of CFM and LCM

## HighD Dataset

Actual vehicle trajectories captured by a drone along German highways

- Using computer vision algorithms
- Detection and localisation of vehicles within each frame by utilisation of neural networks
- 3,074 distinct vehicles
- 400-meter segment

## Results



The coefficient of determination between observed and simulated distances between adjacent vehicles consistently ranges from 0.77 to 0.99.

| Car Following Model (CFM)          |                           | $R^2 = 0.888$ |
|------------------------------------|---------------------------|---------------|
| X-Acceleration ( $m/s^2$ )         |                           |               |
| Variable                           |                           | Coefficient   |
|                                    | constant                  | 0.0025        |
| Acceleration                       | Preceding                 | 0.6374        |
|                                    | Following                 | 0.4884        |
| Acceleration difference with       | Preceding                 | 0.6492        |
|                                    | Following                 | 0.5072        |
|                                    | X-velocity <sup>0.5</sup> | 0.0039        |
| Velocity difference with           | Preceding                 | 9.63e-05      |
| Lane Changing Model (LCM)          |                           | $R^2 = 0.871$ |
| Y-Acceleration ( $m/s^2$ )         |                           |               |
|                                    | constant                  | 0.0023        |
| Acceleration                       | Preceding                 | 0.5103        |
|                                    | Following                 | 0.5861        |
|                                    | Right Following           | 0.2209        |
| Acceleration difference with       | Preceding                 | 0.5188        |
|                                    | Following                 | 0.5915        |
|                                    | Right Following           | 0.2183        |
| Reverse distance difference with   | Left Following            | -0.0357       |
| Square acceleration previous frame |                           | 0.1774        |

## Simulation Model Validation

