

Localising System Parameters Leading to Autonomous Driving Collisions

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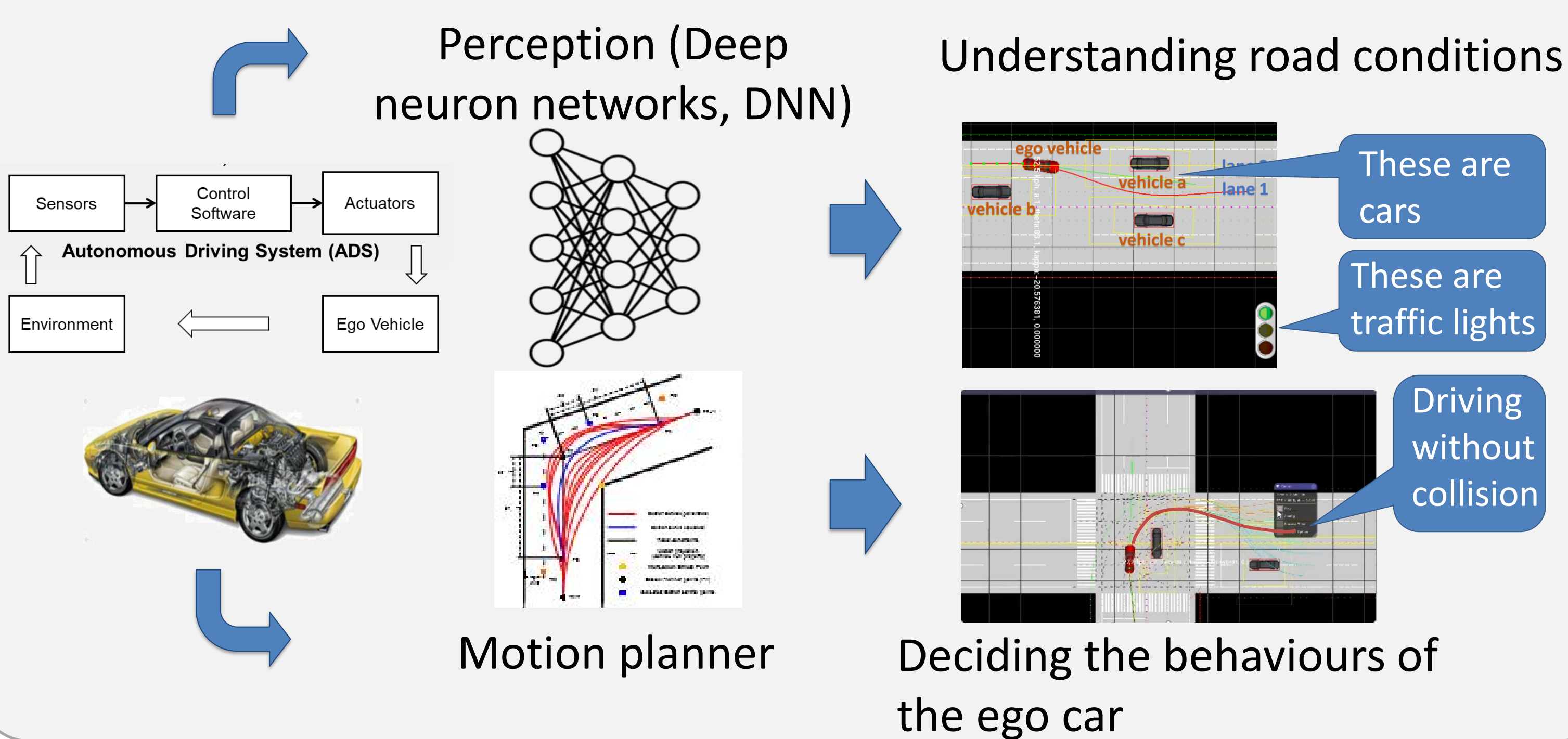
Problem

- Several benefits from Autonomous Driving (AD)
- However, collisions during AD can lead to disruptive damages
- Important to explore why these collisions can occur and how to solve them
- Autonomous Driving Systems (ADS) contain various components with various parameters
- Difficult to localise the *suspicious* parameters

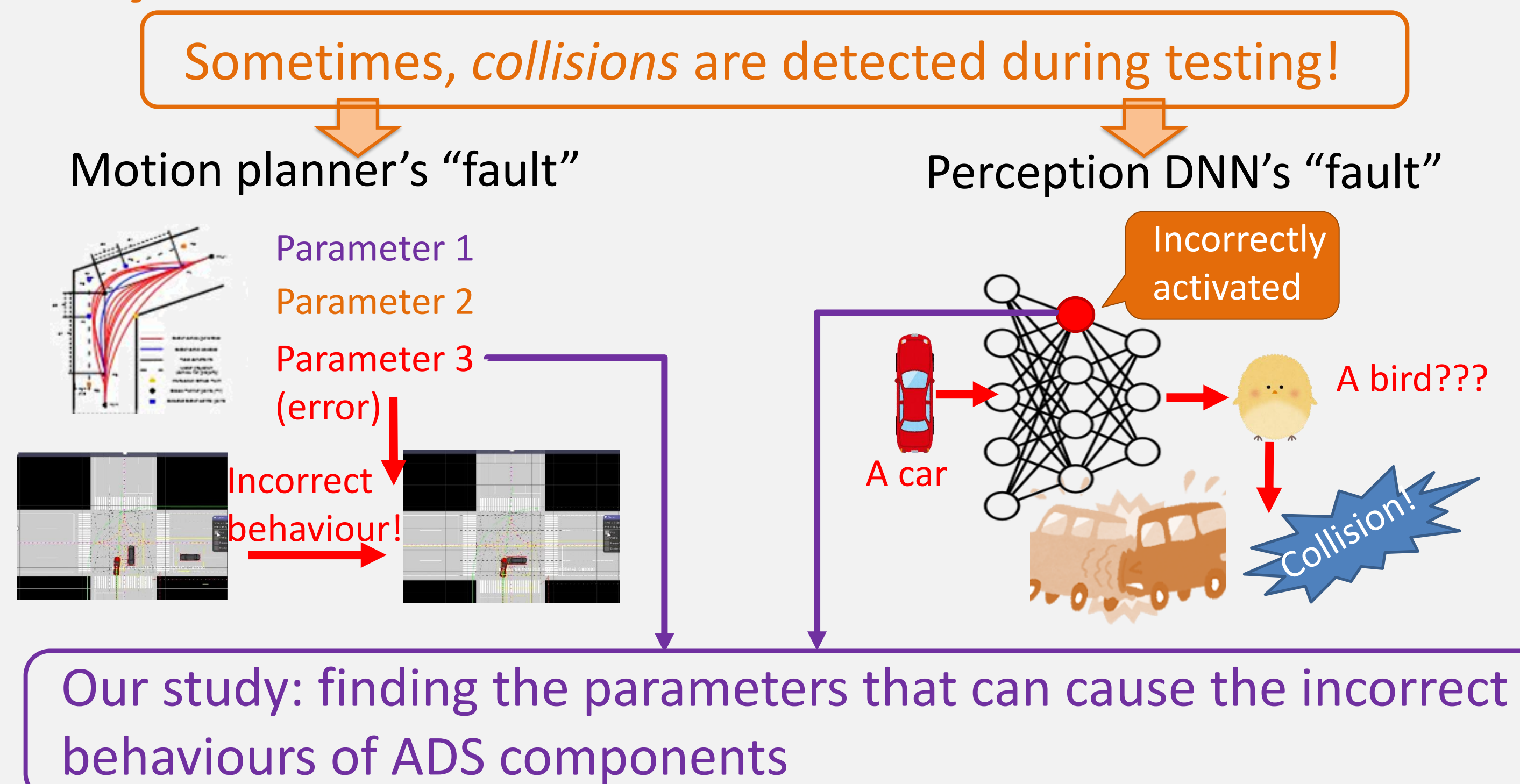
Our study

- We propose an approach to assess ADS collisions
- We apply spectrum-based techniques (borrowed from software debugging) to analyse the relationship between the incorrect behaviours of ADS components and the parameters of these components
- Our approach shows which parameters can cause AD collisions

Autonomous Driving Systems (ADS)

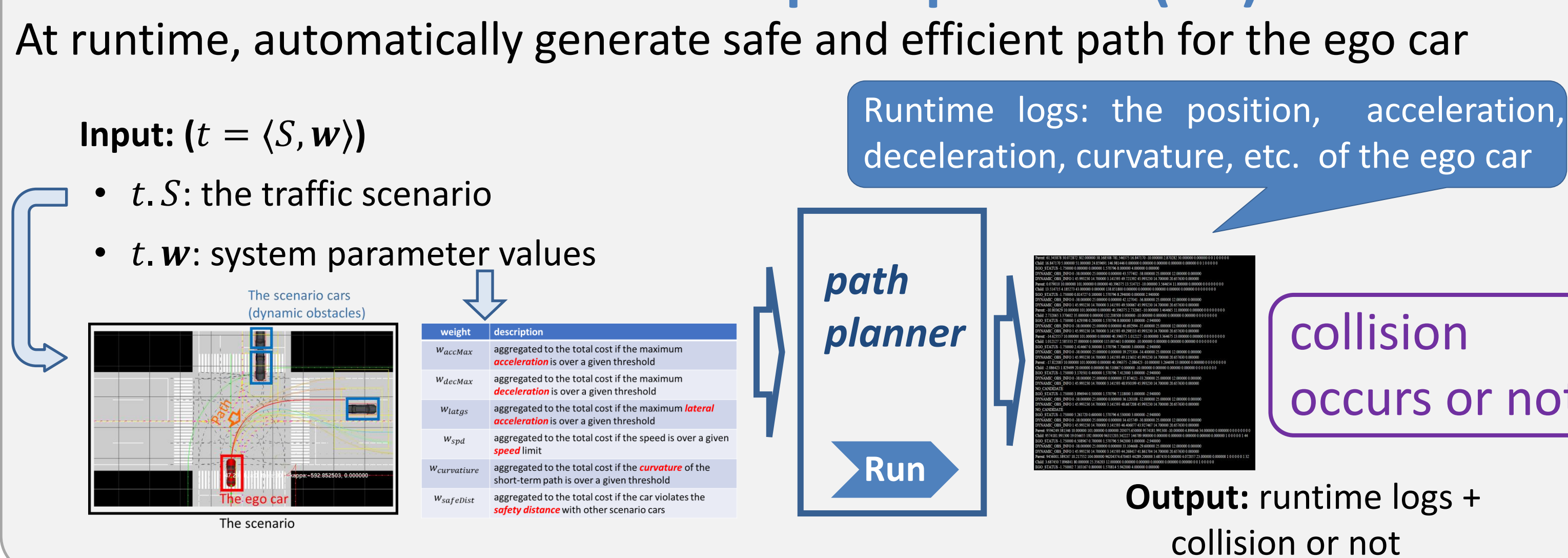


Why can collisions occur?

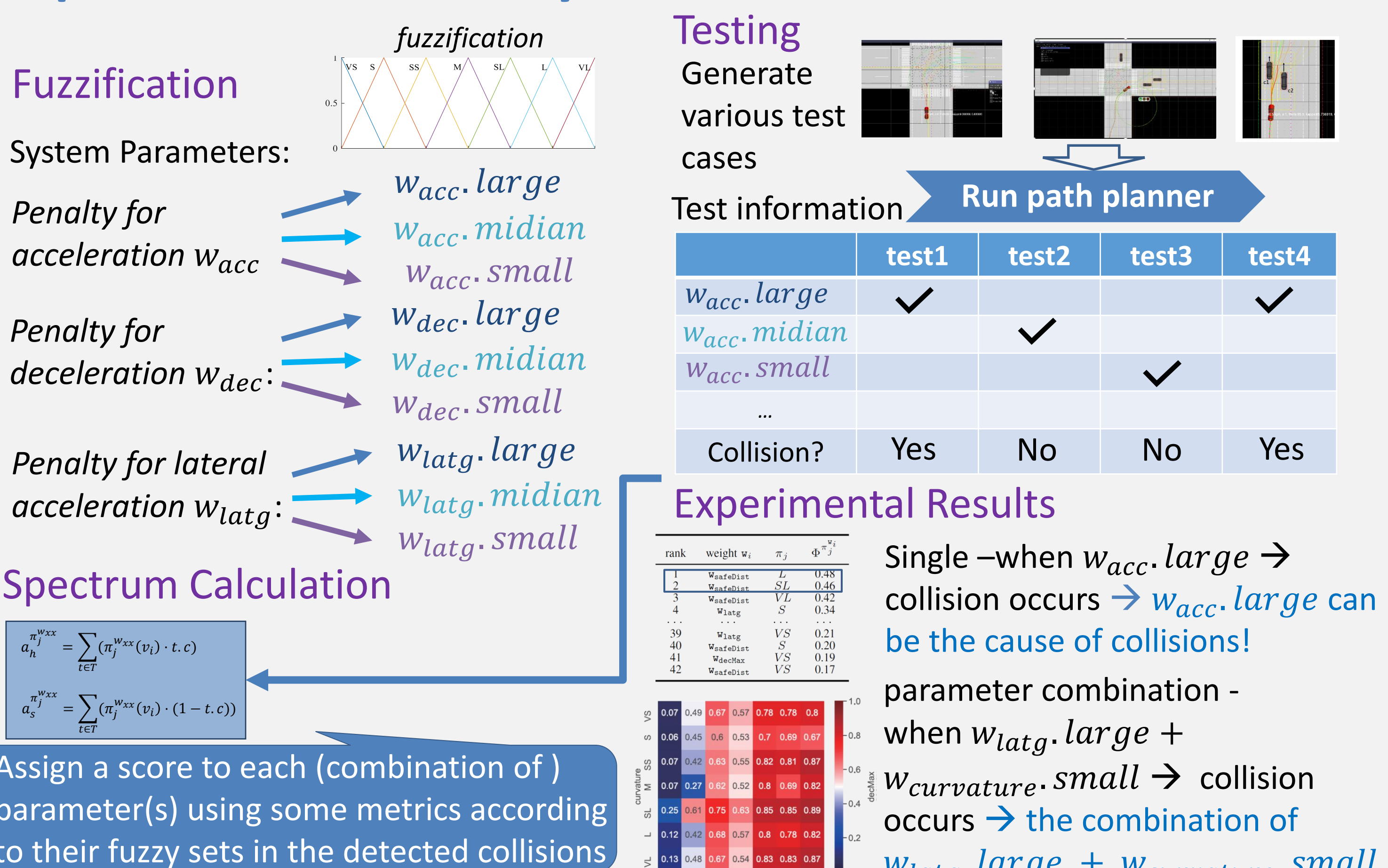


Localising suspicious path planner parameters

Benchmark: an industrial path planner (PP)

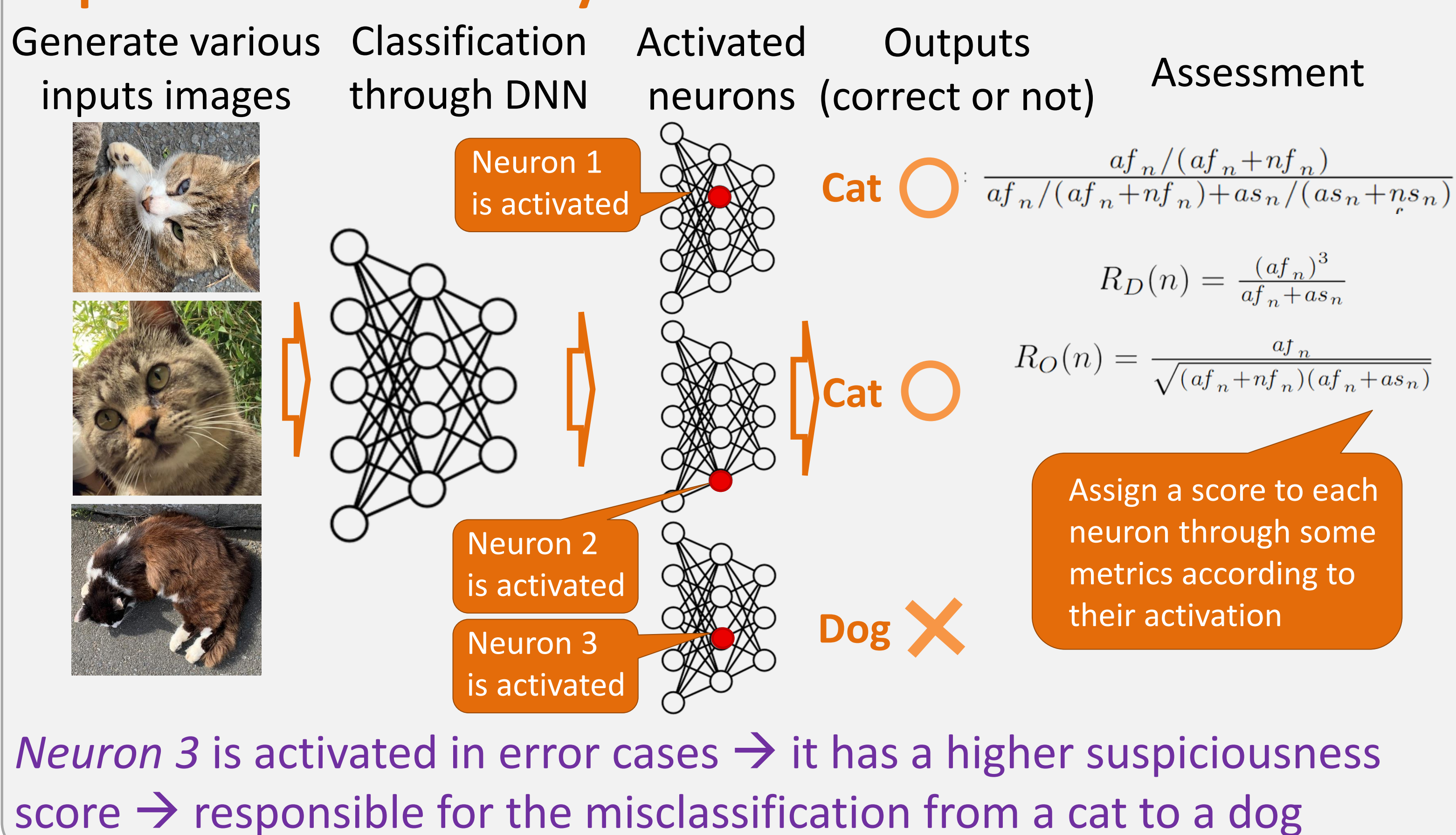


Spectrum-based analysis for PP



Localising suspicious neurons for DNNs

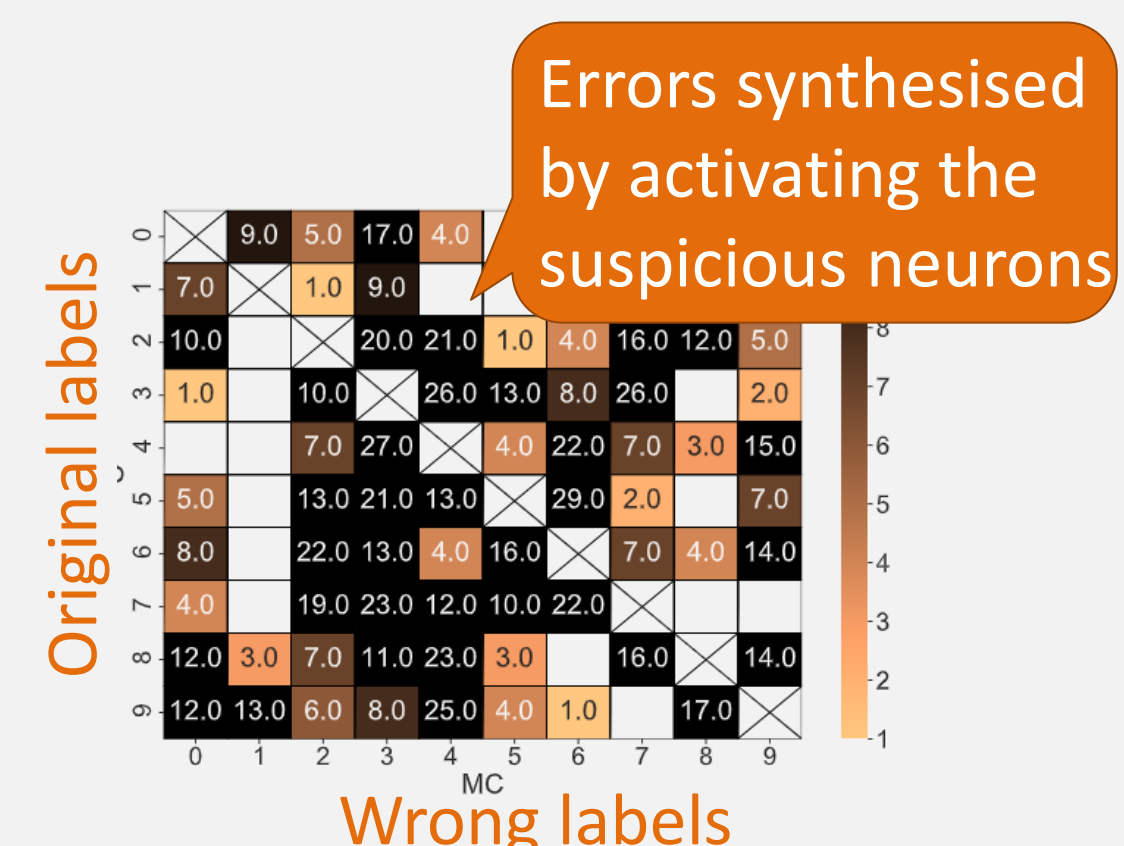
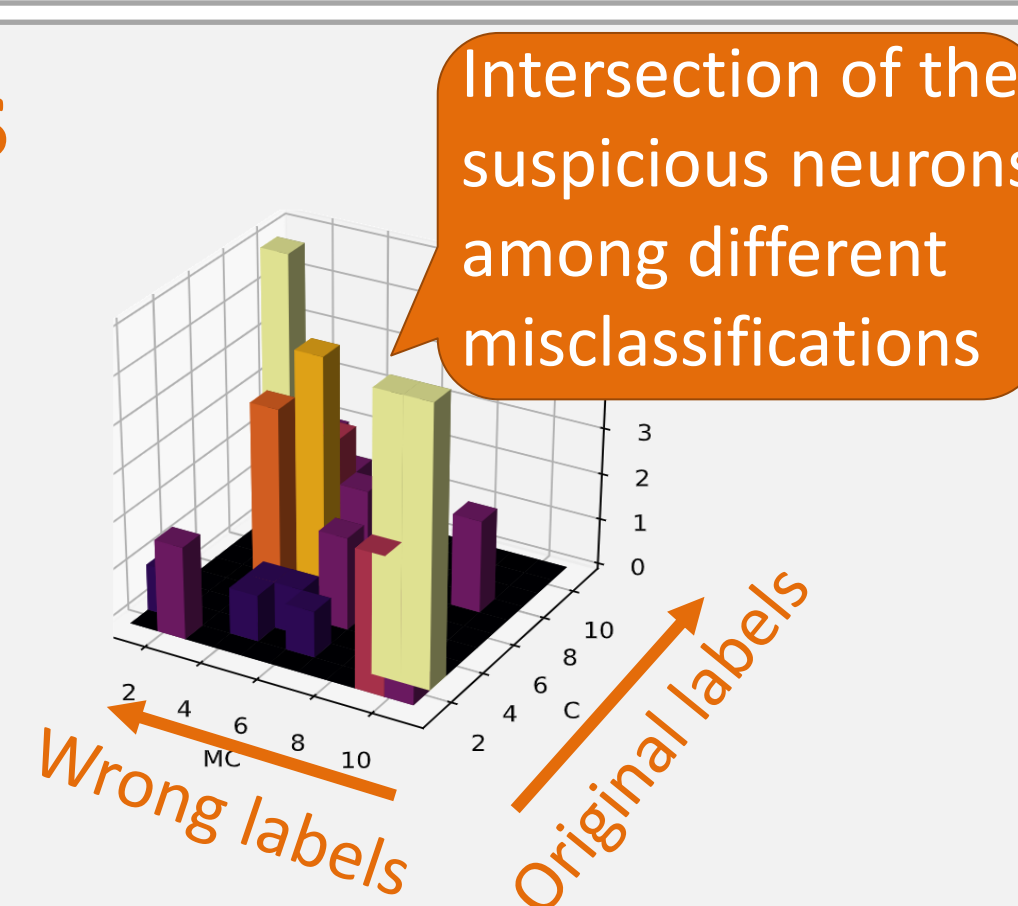
Spectrum-based analysis for DNN models



Experiments

Dataset - MNIST, CIFAR10

DNN - CNN with various structures



The intersection sizes are small → Different misclassifications are caused by different neurons

Synthesising inputs by triggering the suspicious neurons can indeed produce misclassifications (errors)!