Sociopathfinders

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Computational Intelligence
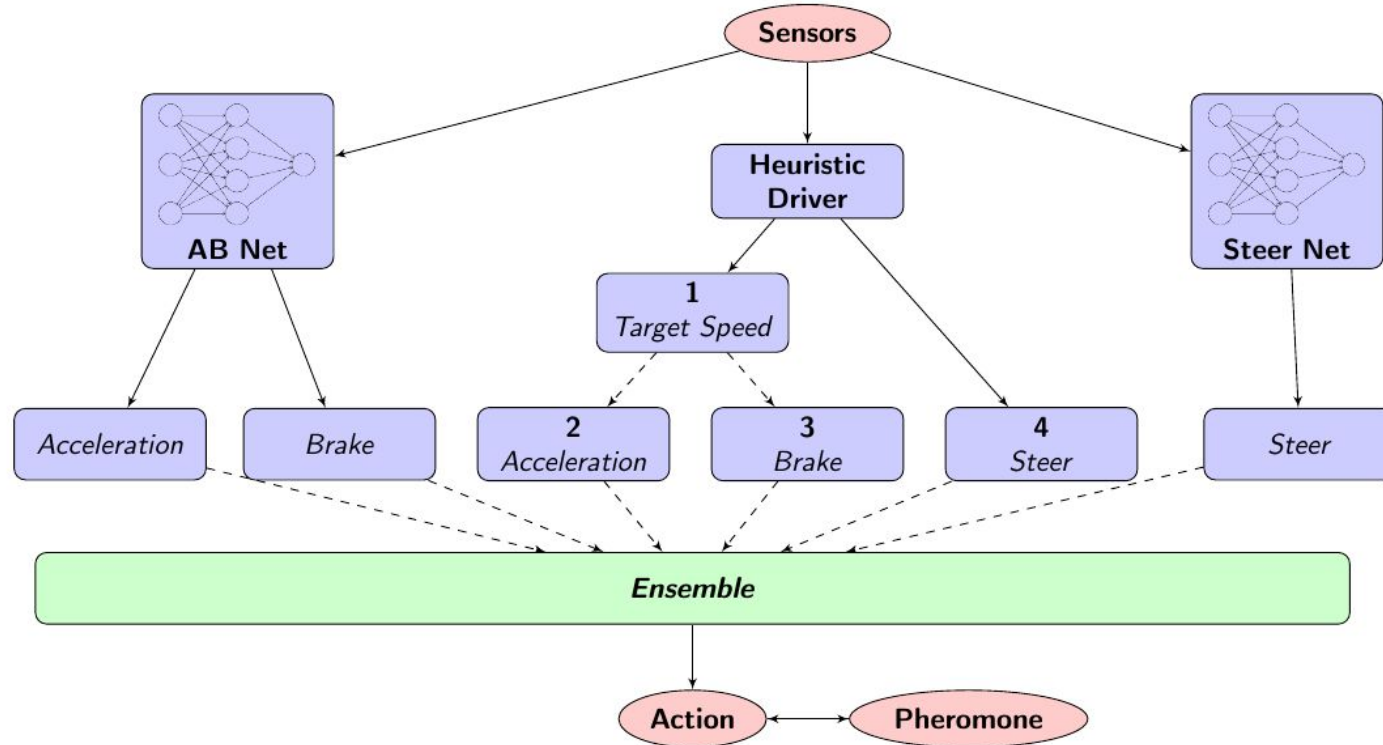
MSc Artificial Intelligence

December, 2016

UNIVERSITY OF AMSTERDAM

# Design Methodology

Neural Networks

- Multi-layer perceptrons, ESN, ELM

- Generated training data on built-in controller with global model of tracks

  - 1,6M ticks of different scenarios (solo races, competitions, different track types)

- Feature engineering + separate network for each output = good results!

  - hand-crafted features such as curvature, smoothing the data, applying PCA

- Pros

  - Good acceleration and precise steering on average

- Cons

  - Overfitting: poor generalization on unseen situations like crashing, being off-track
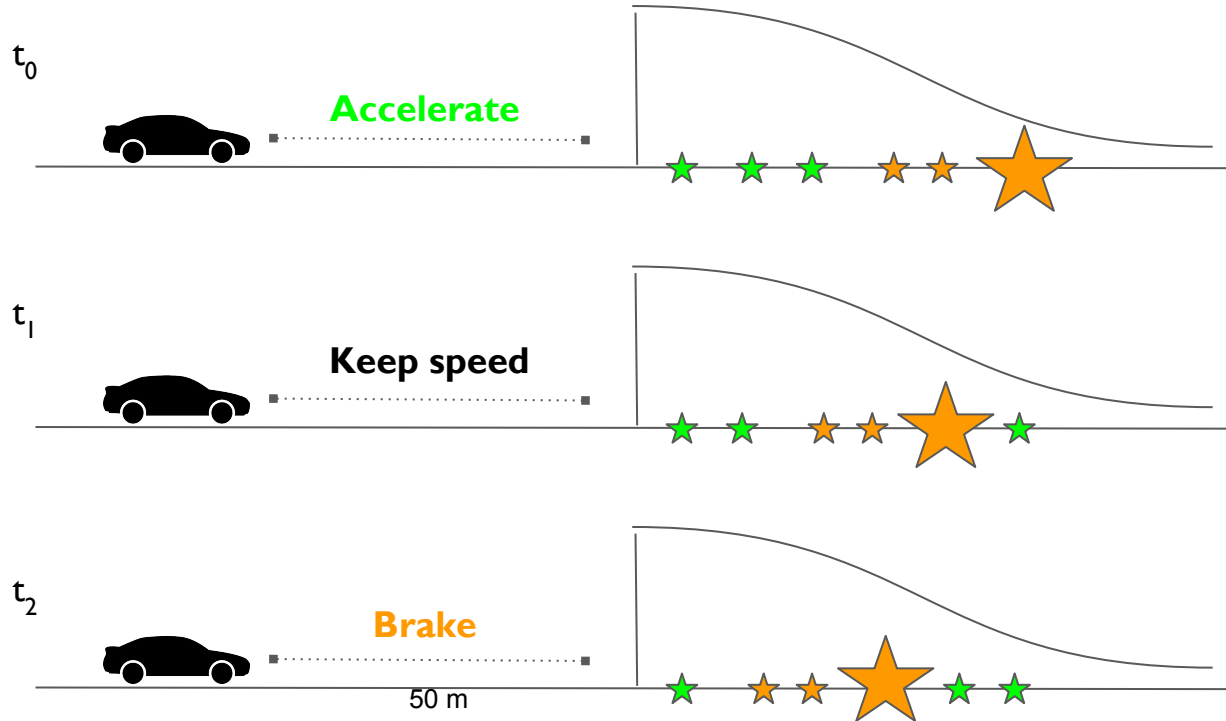
Heuristics

- State-of-the-art: COBOSTAR[1]
  - Steering: towards the longest track sensor
  - Target velocity: computed from distance ahead, steering
- Overtaking heuristic: Socio-pathfinders
  - If steering towards opponent: go towards next longest (unblocked) track sensor
- Pros
  - Robustness across track types
- Cons
  - Too prudent

[1] M. V. Butz and T. D. Lonneker, "Optimized sensory-motor couplings plus strategy extensions for the torcs car racing challenge," in 2009 IEEE Symposium on Computational Intelligence and Games, Sept 2009, pp. 317–324.

Swarm Intelligence
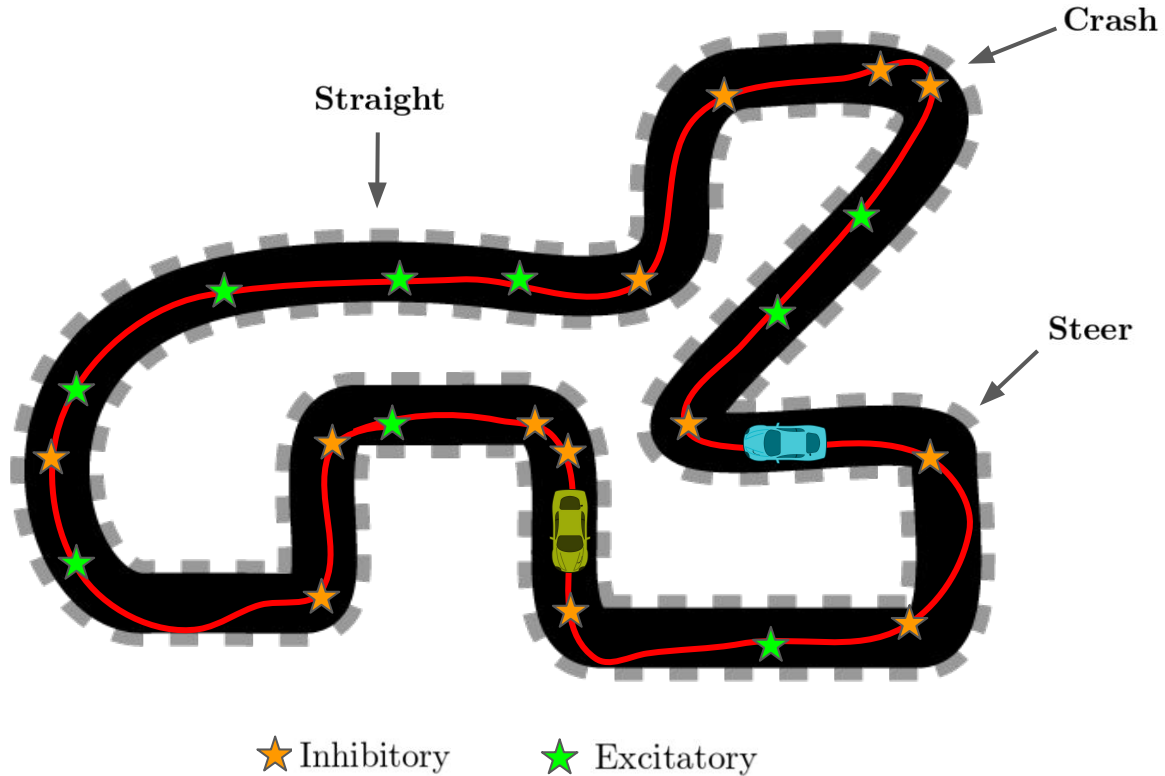
Swarm Intelligence

Evolutionary Optimization

- Final model: weighted average of NN + Heuristics + Swarm Intelligence

- Differential Evolution

  - Meta-heuristic search for candidate solution in a restricted domain

  - Fitness evaluated on race position with TORCS bots

  - Re-tune parameters and mixing coefficients

- Results

  - In theory a great solution

  - In practice, slow as requires many TORCS simulations (~ 3-5 min. for one evaluation)

- Other experiments:

  - NEAT - online and offline on data → no convergence, instabilities, hard to integrate results

  - Genetic Algorithm on parameter chromosomes → slow convergence, slight improvements

Thank you!

Many thanks to Baris for putting up with all our emails!