Atlas: a Benchmarking Tool for Human Motion Prediction Algorithms

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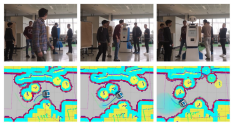
Benchmarking Human Motion Prediction Algorithms
Motion prediction in social navigation

SPENCER: A Socially Aware Service Robot for Passenger Guidance and Help in Busy Airports



Schoels et al. 2020, "An NMPC approach using convex inner approximations for online motion planning with guaranteed collision avoidance"

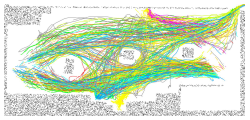
- Human motion prediction is an essential part of social navigation

Benchmarking Human Motion Prediction Algorithms
Prior art: TrajNet++ benchmark

Kothari et al. 2020, "Human Trajectory Forecasting in Crowds: A Deep Learning Perspective"

- TrajNet++ does not support obstacles and is limited in the experiment design (only accuracy measurements)

Benchmarking Human Motion Prediction Algorithms
Obstacle-heavy scenarios in social navigation



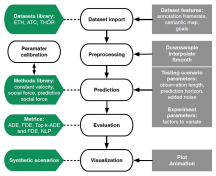
Rudenko et al. 2020, "THÖR: Human-Robot Navigation Data Collection and Accurate Motion Trajectories Dataset"

Bruckschen et al. 2020, "Human-Aware Robot Navigation by Long-Term Movement Prediction"

- Obstacles are an important cue for human motion in mobile service and industrial robotics settings

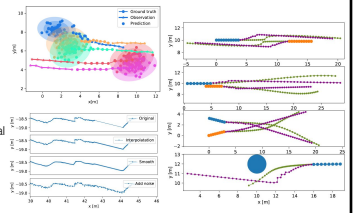
Benchmarking Human Motion Prediction Algorithms
Atlas: a new benchmarking tool for motion prediction algorithms

- Atlas introduces a collection of tools, experiments and metrics to better evaluate motion prediction methods
- Automated testing scenarios extraction from a raw dataset
- Automated experiments with key parameter variation:
  - Accuracy conditioned on varied observation and prediction length
  - Knowledge transfer between environments
  - Robustness against perception noise



Benchmarking Human Motion Prediction Algorithms
Atlas features

- Support for obstacle and semantic maps
- Trajectory processing tools
- Flexible uncertainty representation
- Synthetic scenarios for visual qualitative inspection



Benchmarking Human Motion Prediction Algorithms
Investigating the predictive social force models

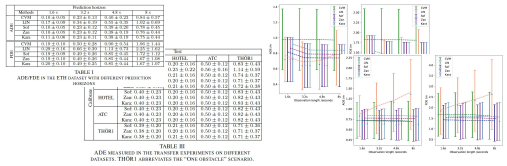


TABLE I
ADE/FDE IN THE ETH DATASET WITH DIFFERENT PREDICTION HORIZONS

TABLE II
ADE MEASURED IN THE TRANSFER EXPERIMENTS ON DIFFERENT DATASETS. THÖR-1 ABBREVIATES THE "ONE OBSTACLE" SCENARIO.

- Using the experiments in Atlas, we investigated the potential of two popular predictive social force models in human motion prediction
  - Zanlungo et al. 2011, "Social force model with explicit collision prediction"
  - Karamouzas et al. 2009, "A predictive collision avoidance model for pedestrian simulation"

Benchmarking Human Motion Prediction Algorithms
Next steps

- Soon to be released as a tool to work with THÖR and other datasets
- Further datasets and prediction baselines to be added

Thank you for you attention and see you at the poster session!