Deep Reinforcement Learning-Based Mapless Crowd Navigation with Perceived Risk of the Moving Crowd for Mobile Robots

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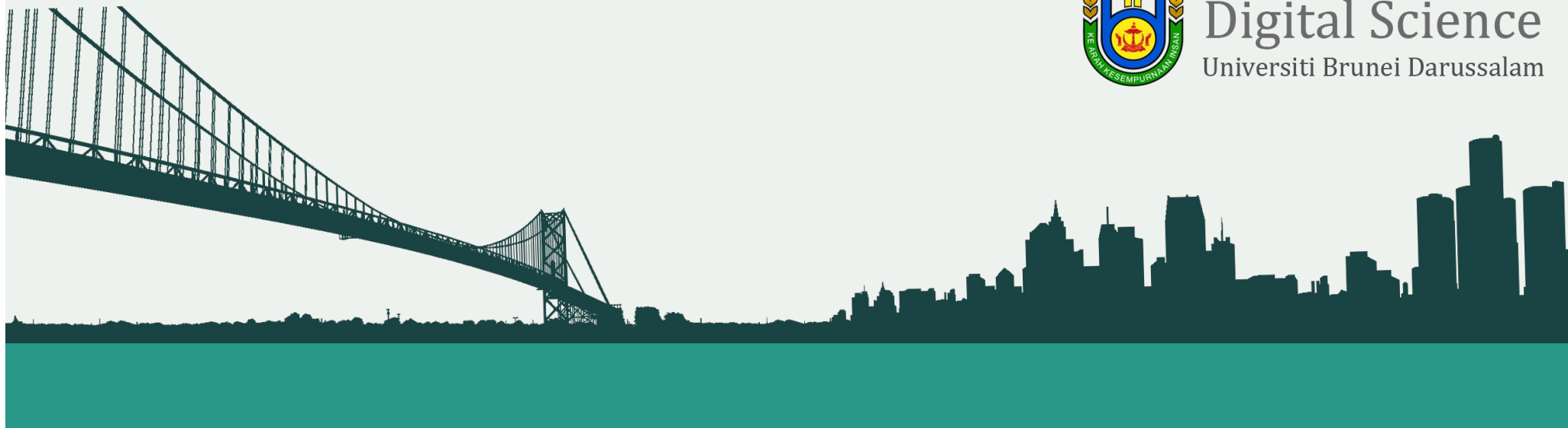
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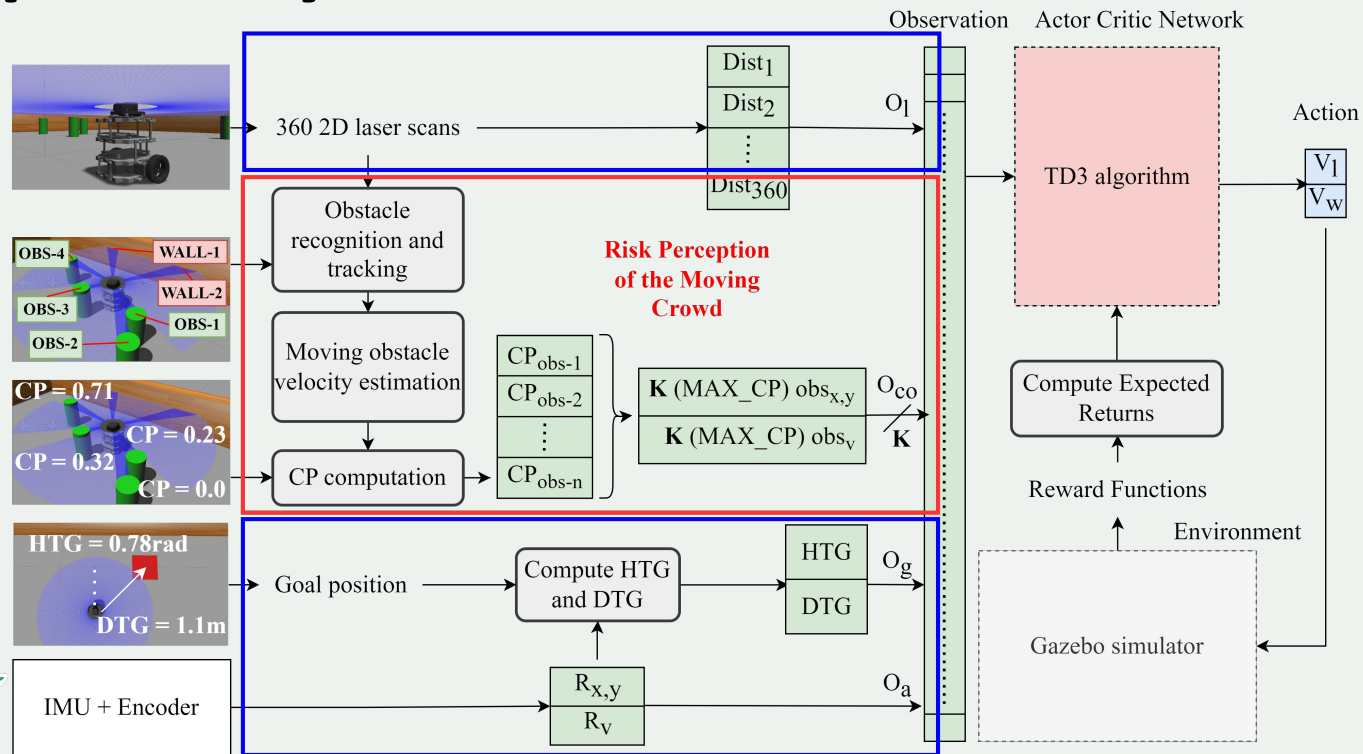
Related works

- Mapless + 2D laserscan + DRL navigation
    - Virtual-to-real navigation (Tai et al., IROS2017)
    - Curiosity-driven exploration (Zhelo et al., ICRA2018)
- Crowd Navigation + DRL
    - CrowdMove (Long et al., ICRA2018)
    - CADRL (Everett et al., IROS2018)
    - Social-safety aware navigation (Jin et al., ICRA2020)
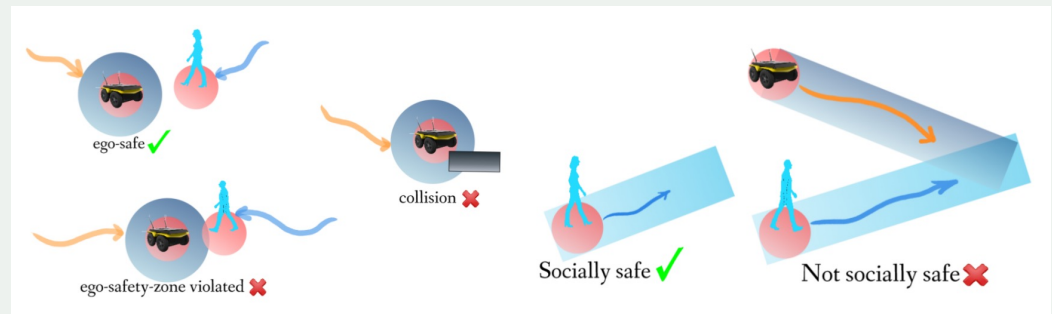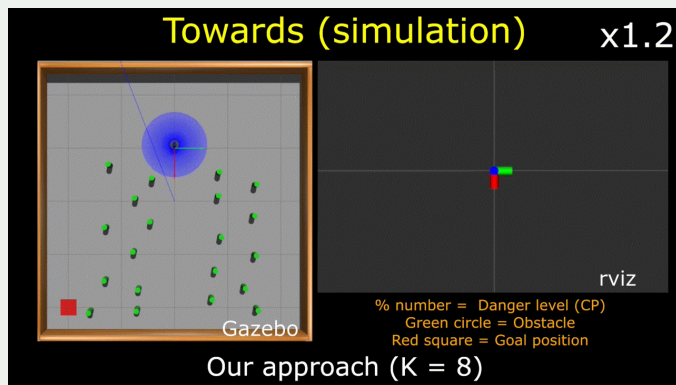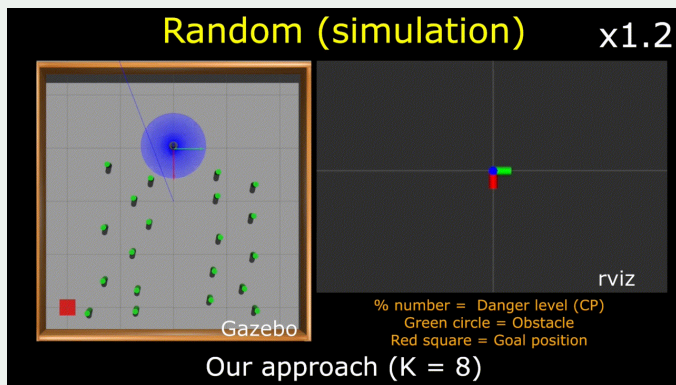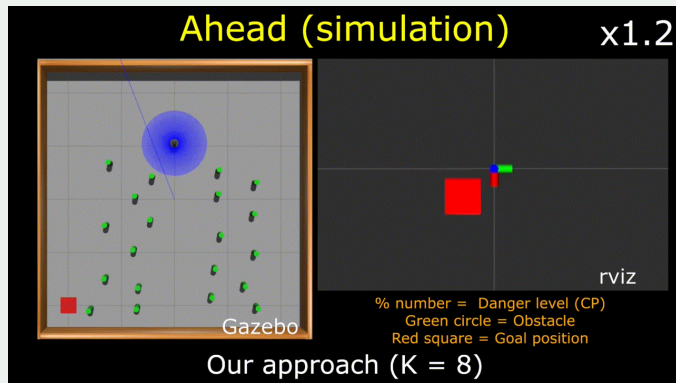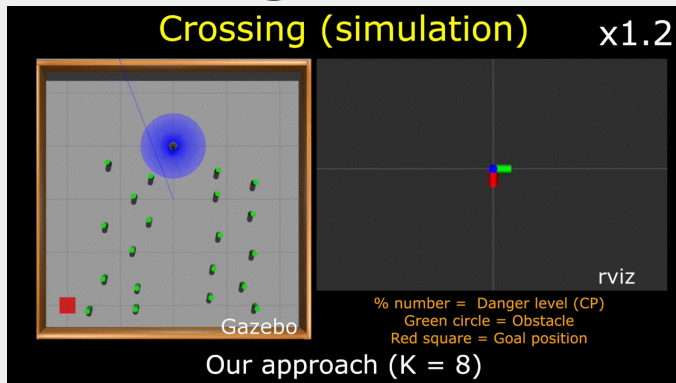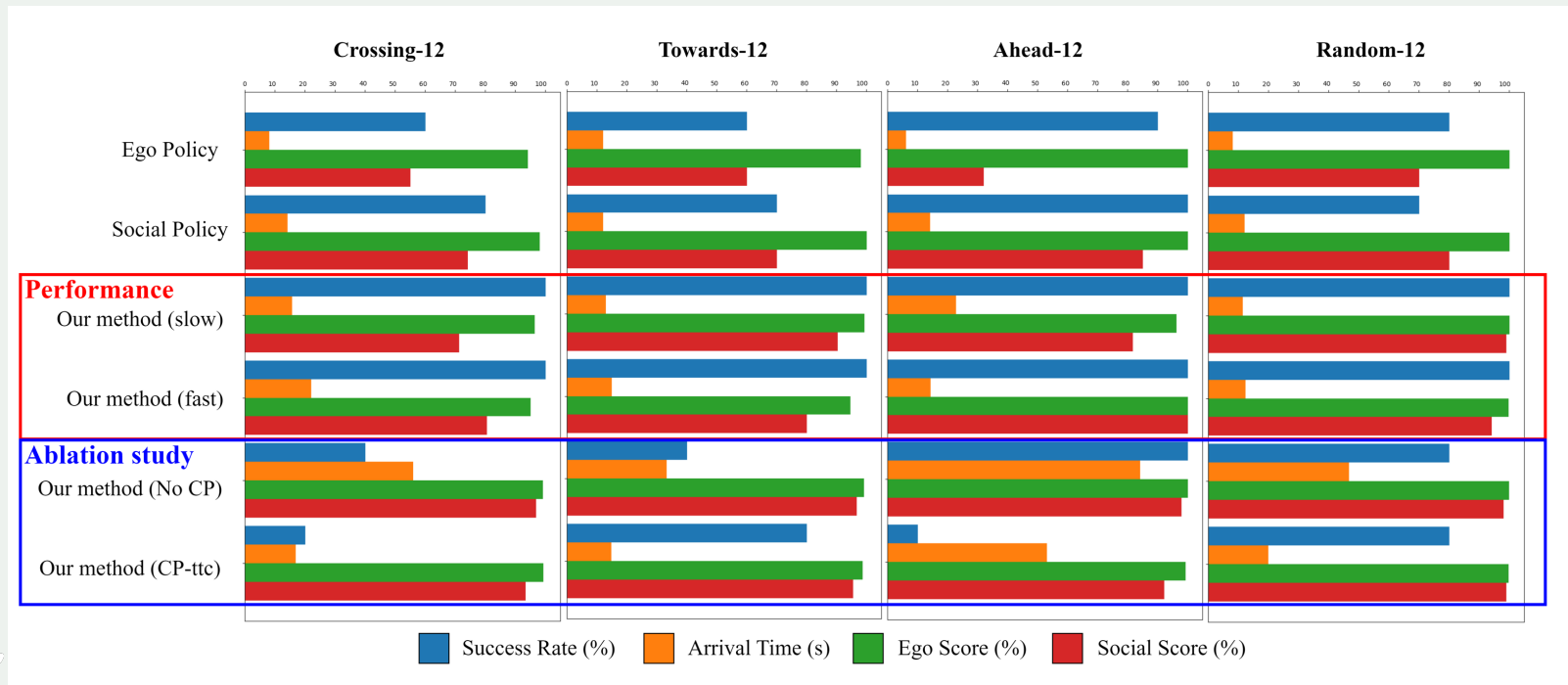
Proposed system

Navigation performance measure

- Success Rate (0-100%)
- Arrival Time (s)
- Ego-safety Score (0-100%) (Jin et al., ICRA2020)
- Social-safety Score (0-100%) (Jin et al., ICRA2020)

Crowd navigation: Tests

Crowd navigation: Results

- Our proposed method achieves higher success rates.
- The ablation study highlights the effectiveness of our approach.

Conclusion

- Mapless crowd navigation approach has been presented
  - DRL + Mapless + Risk Perception with 2D laser scans
- The inclusion of Risk Perception to the observation space can significantly improve crowd navigation performance.
  - The perception of risk has enabled the robot to take calculated risk in navigating the crowd.

Future works

- Expand the simulated and real-world tests, and improve real-world performance.
- Investigate further ways to incorporate perceived risk or human awareness in our crowd navigation approach.