Neural Graph Control Barrier Functions Guided Distributed Collision-avoidance Multi-agent Control

REALM

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Learning Generalizable Distributed Controller
Trained on 10s and Deployed on 1000s of Agents

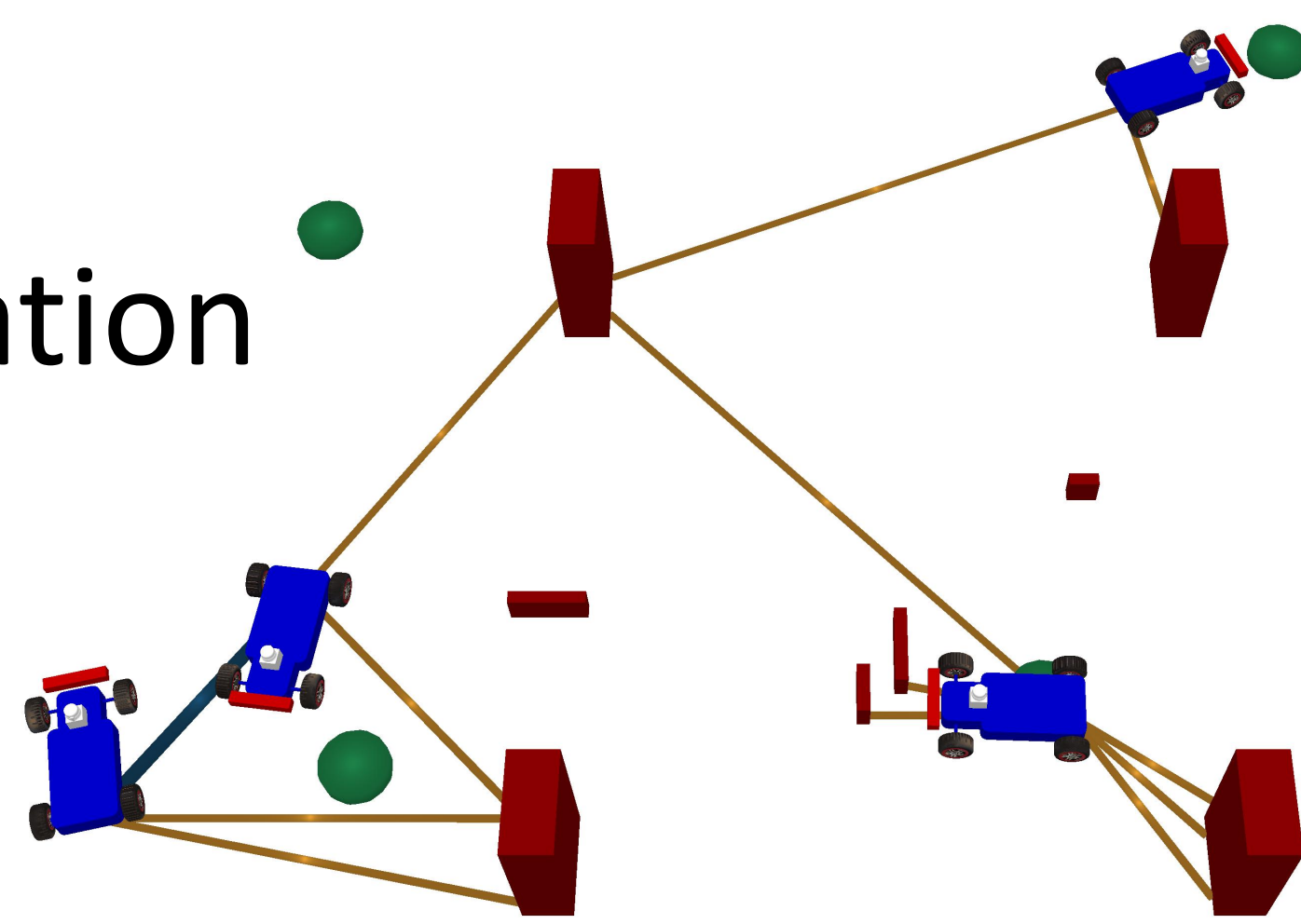## Distributed Collision-avoidance Multi-agent Control Problem
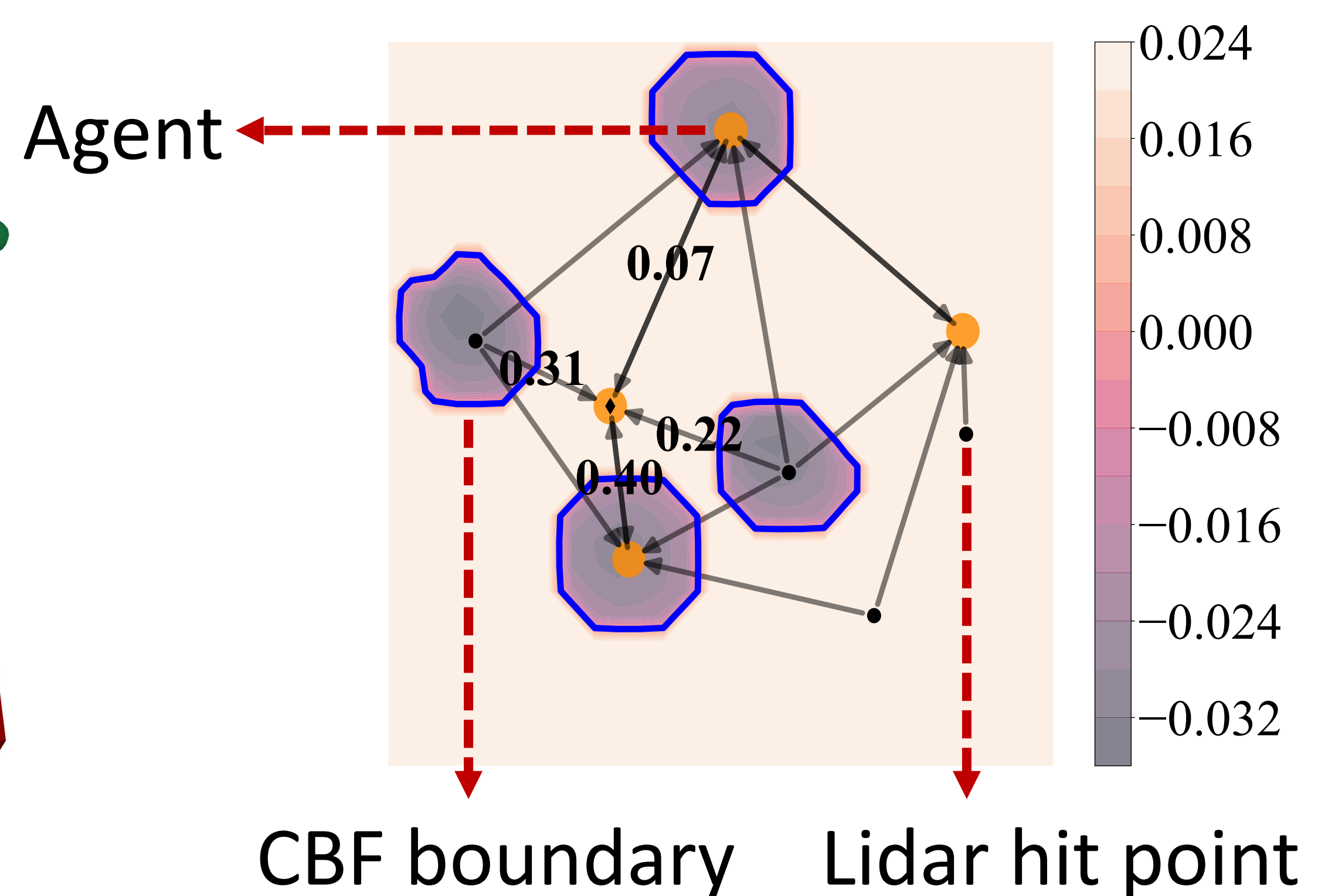
Objective:
- Safety and goal-reaching

Input:
- Local LiDAR observation

Desired Features:
- Large # agents
- Any dynamics

Neural Graph Control Barrier Functions (GCBF)

Agent
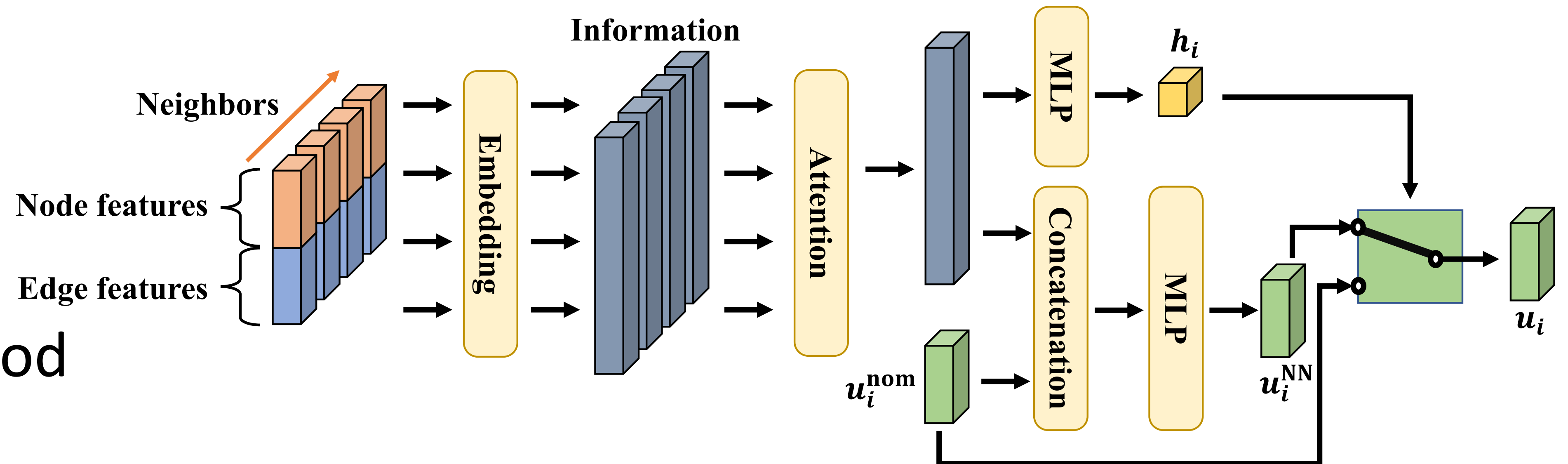Success rate
Number of obstacles
CBF boundary
Lidar hit point

Learning GCBF and Collision-avoidance Controller with Graph Neural Networks

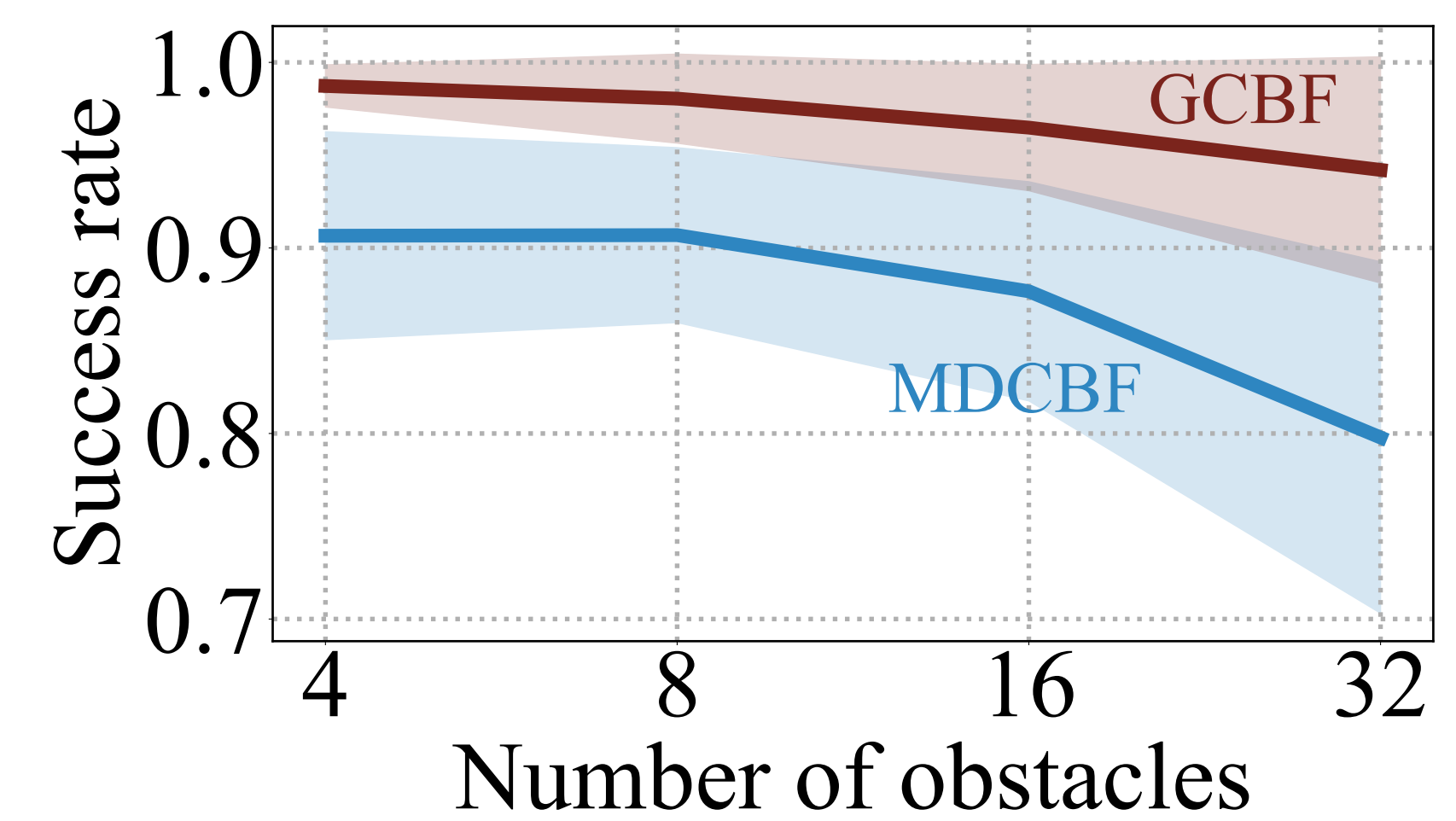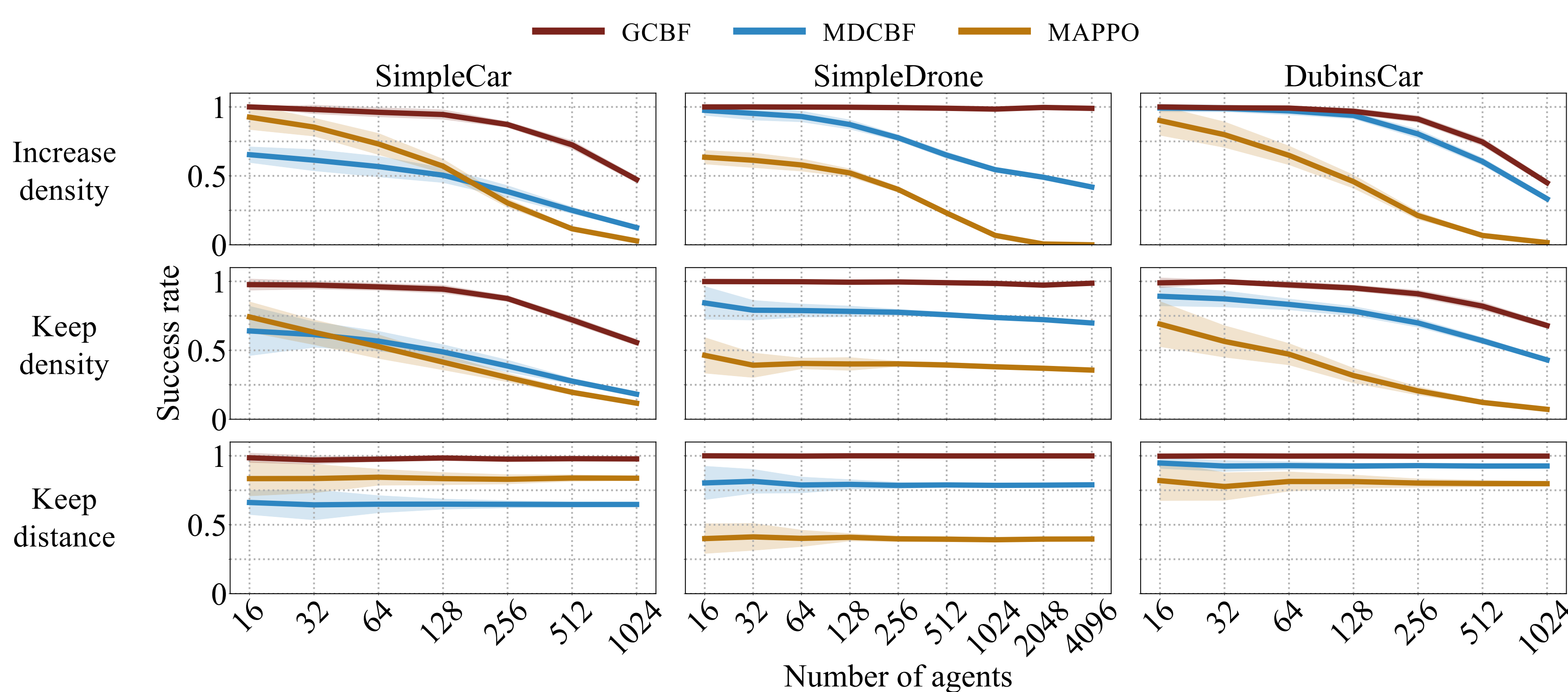**GNN:**
- Varying # neighbors

Attention:
- Changing neighborhood
- Different importance

Experiments

Training: 16 agents, 8 static point obstacles
Testing: 16 - 4096 agents, 4 - 32 moving large obstacles

- GCBF achieves the **highest** success rate because of the **better structure** than MDCBF.
- RL **sacrifices** safety.