

NRI-FND: Probabilistic Hypothesis Driven, Adapting, Human-Robot Teams

Mark Campbell (PI), Jacopo Banfi, Vikram Shree, Beatriz Arruda Asfora, Sarah Allen
Cornell University

Project goal: develop foundational theory and validated algorithms for human-robot teams which operate in complex environments *evolving over space and time*

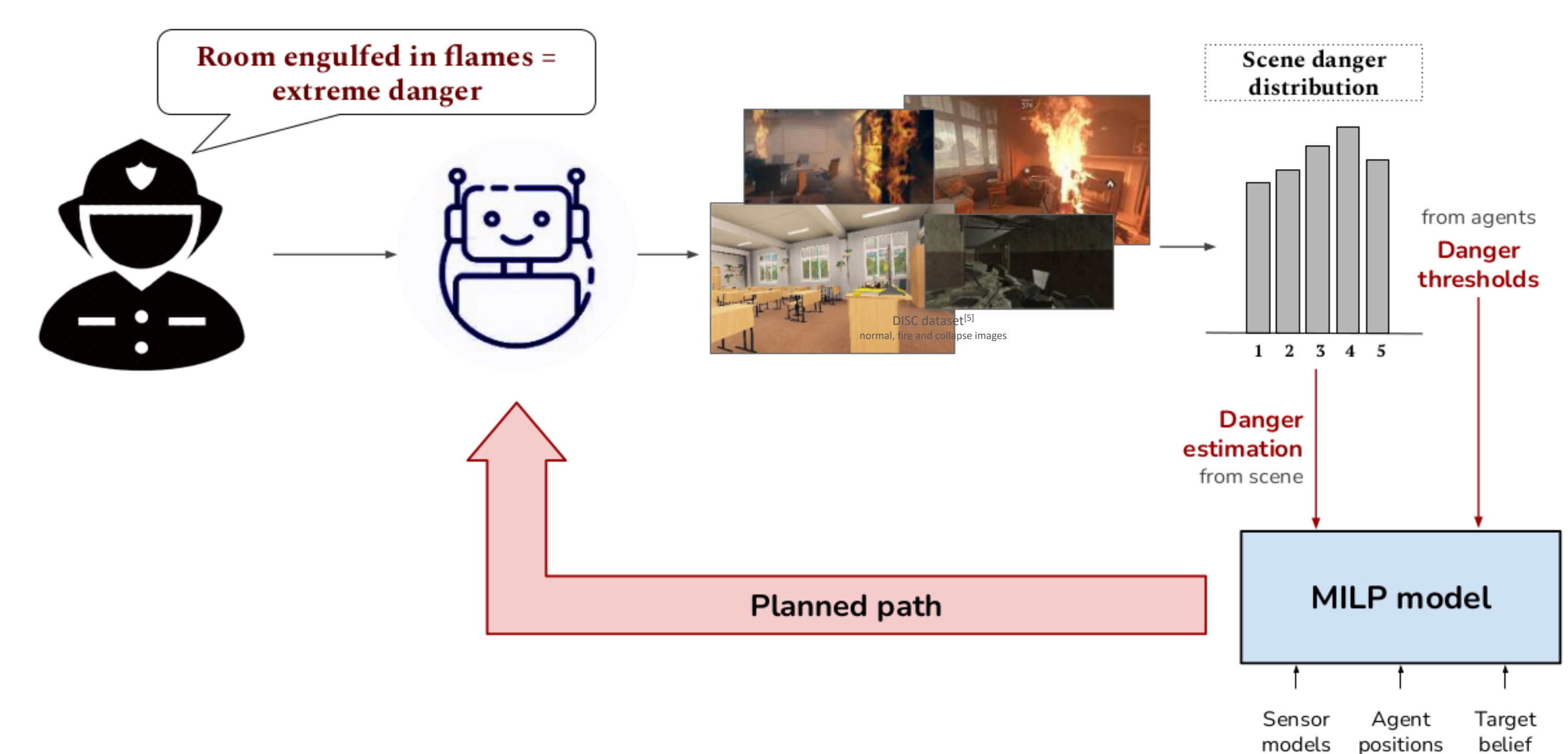
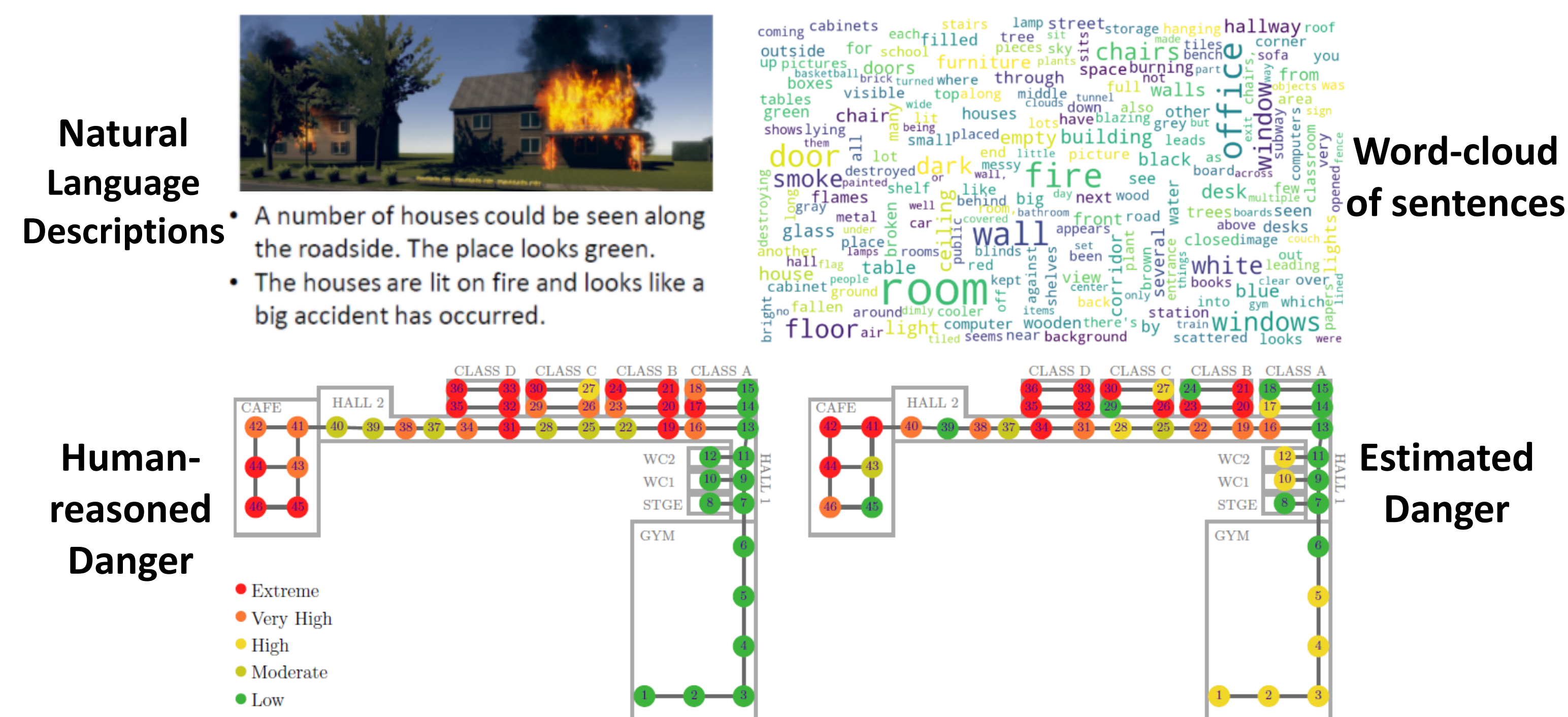
Key problems: human-robot information exchange & human-aware multiagent planning

Unified Scene Perception: Leverage natural language and expert knowledge with robot sensing to estimate danger

- ML model trained on NL and synthetic disaster images
- Can adapt to different emergencies without retraining

Risk aware planner: MILP search planner with danger info and thresholds to balance multi-agent performance and safety

- Centralized & decentralized implementations; 90x SoA
- Scene uncertainty can evolve; danger thresholds can be customized



The project is focused on search and rescue, but the proposed methodology will be more broadly applicable:



The project currently funds two PhD students that are involved in education and outreach activities:



Duckietown project
www.duckietown.org



NYS 4-H Career
Explorations Program

Three journal papers published:

- V Shree, WL Chao and M Campbell. "Interactive Natural Language-based Person Search," in *RA-Letters*, 2020
- BA Asfora, J Banfi, and M Campbell, 2020. Mixed-Integer Linear Programming Models for Multi-Robot Non-Adversarial Search. *RA-Letters* 2020
- V Shree*, BA Asfora*, R Zheng, S Hong, J Banfi and M Campbell. Exploiting Natural Language for Efficient Risk-Aware Multi-robot SaR Planning. *RA-Letters* 2021