

Qualitative Driving Assistance for Everyday Use

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Qualitative Driving Assistant

Nodding or hand movement gestures

- Target direction from multi-valued qualitative direction star
- Special movements, e.g. 180° turns

Set of navigable paths

- From Voronoi Graph representation of the environment
- Filtered for target pose that best matches target direction

Autonomous navigation based on A* search in configuration space

Gesture-based Path Selection

Gestures

- Double pitch/yaw movements (head-joystick)
- Single full deflection (joystick)

Target Pose

- Reachable from current position in Voronoi Graph
- Best match with direction of gesture
- Orientation derived from graph segment before target

Local A*-based Path Planning

Hybrid-State A*: kinematically feasible paths by associating continuous configurations (x, y, θ) with each cell

Simple flood-fill heuristic

- Ignores non-holonomic constraints
- Takes current obstacle situation into account

Configuration space of $250 \cdot 250 \cdot 96 = 6 \cdot 10^6$ cells ($7.5\text{m} \cdot 7.5\text{m} \cdot 360^\circ$)

Typical planning cycles of 10ms

Experimental Evaluation I3-[SharC]

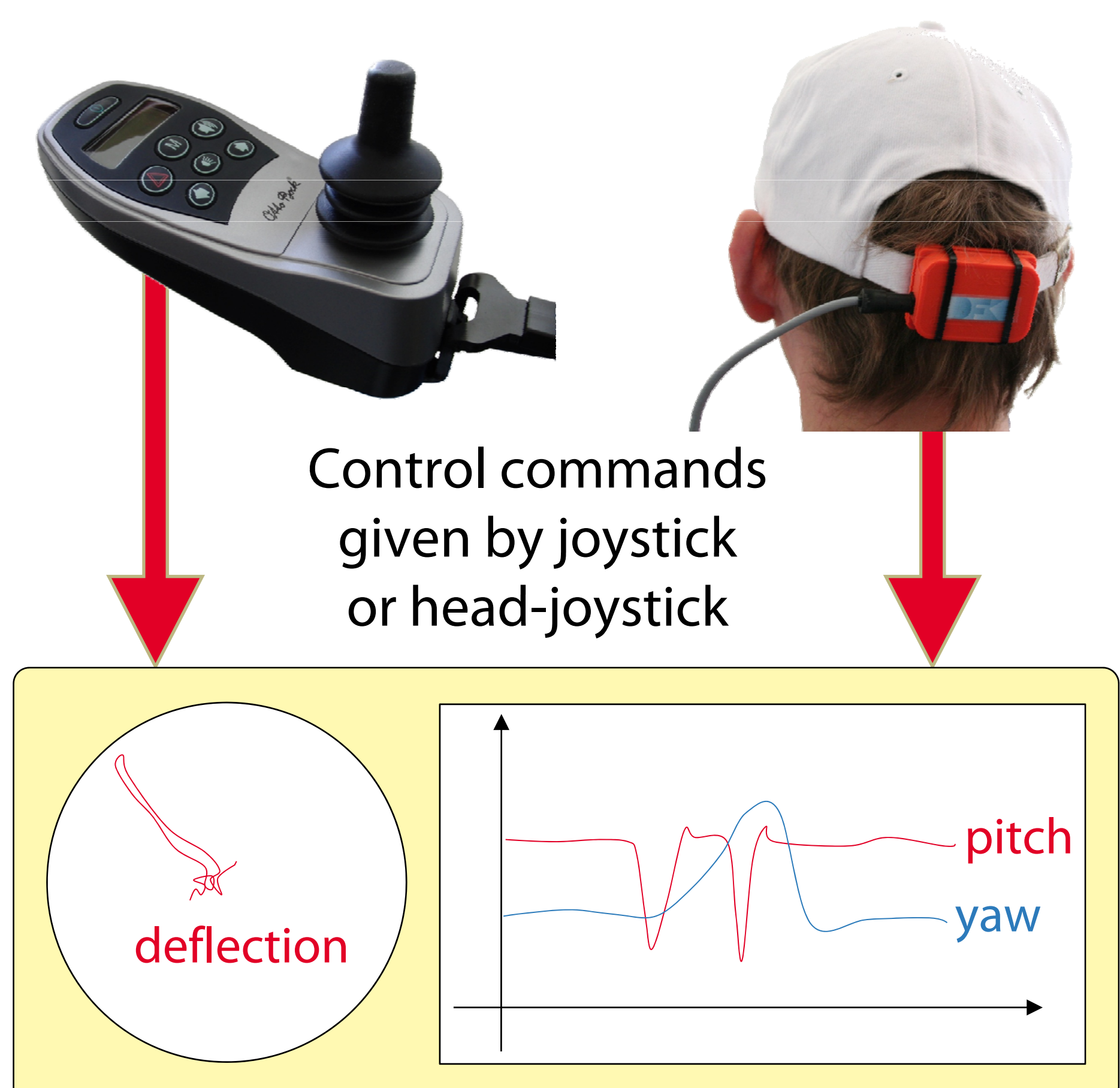
Pilot Studies

- With patients from *Stiftung Friedehorst* in familiar surroundings
- First results: gesture recognition heavily depends on functional impairments of the experimentee's locomotory system

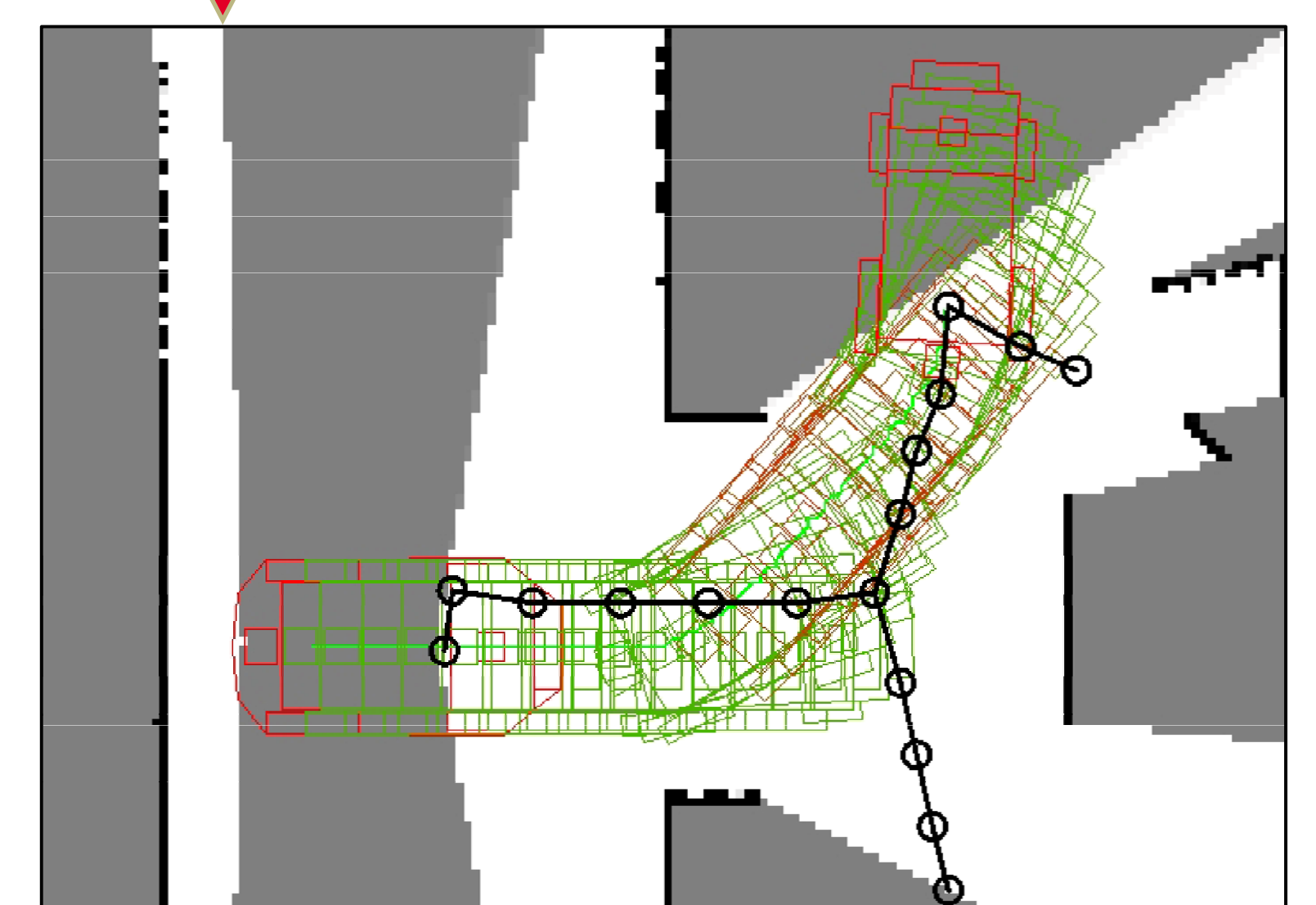
Upcoming evaluation will consider

- Gesture recognition adaptable to different functional impairments by physiotherapeutic assistance
- Combination with closed-loop Driving Assistant

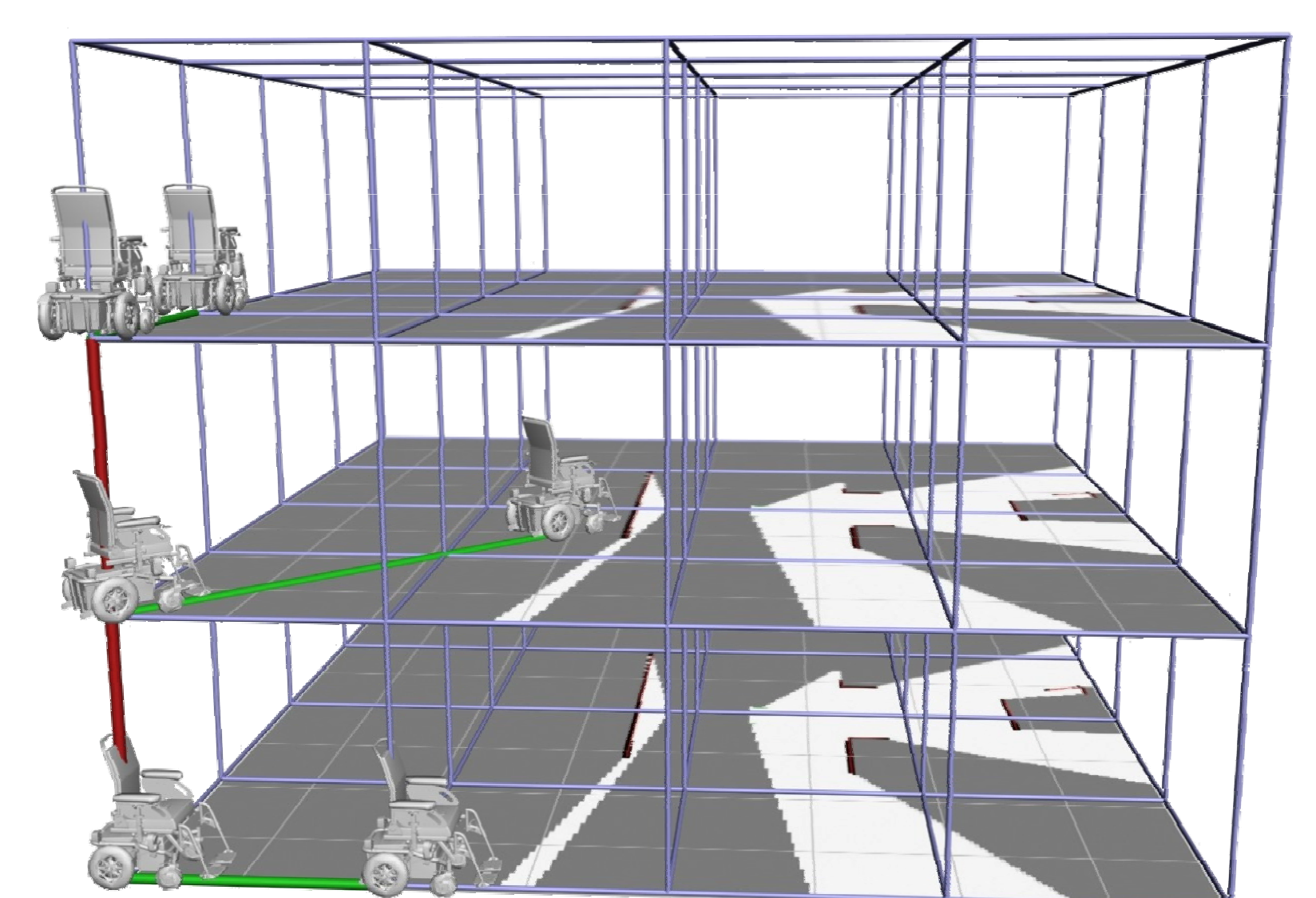
Cooperating Partners



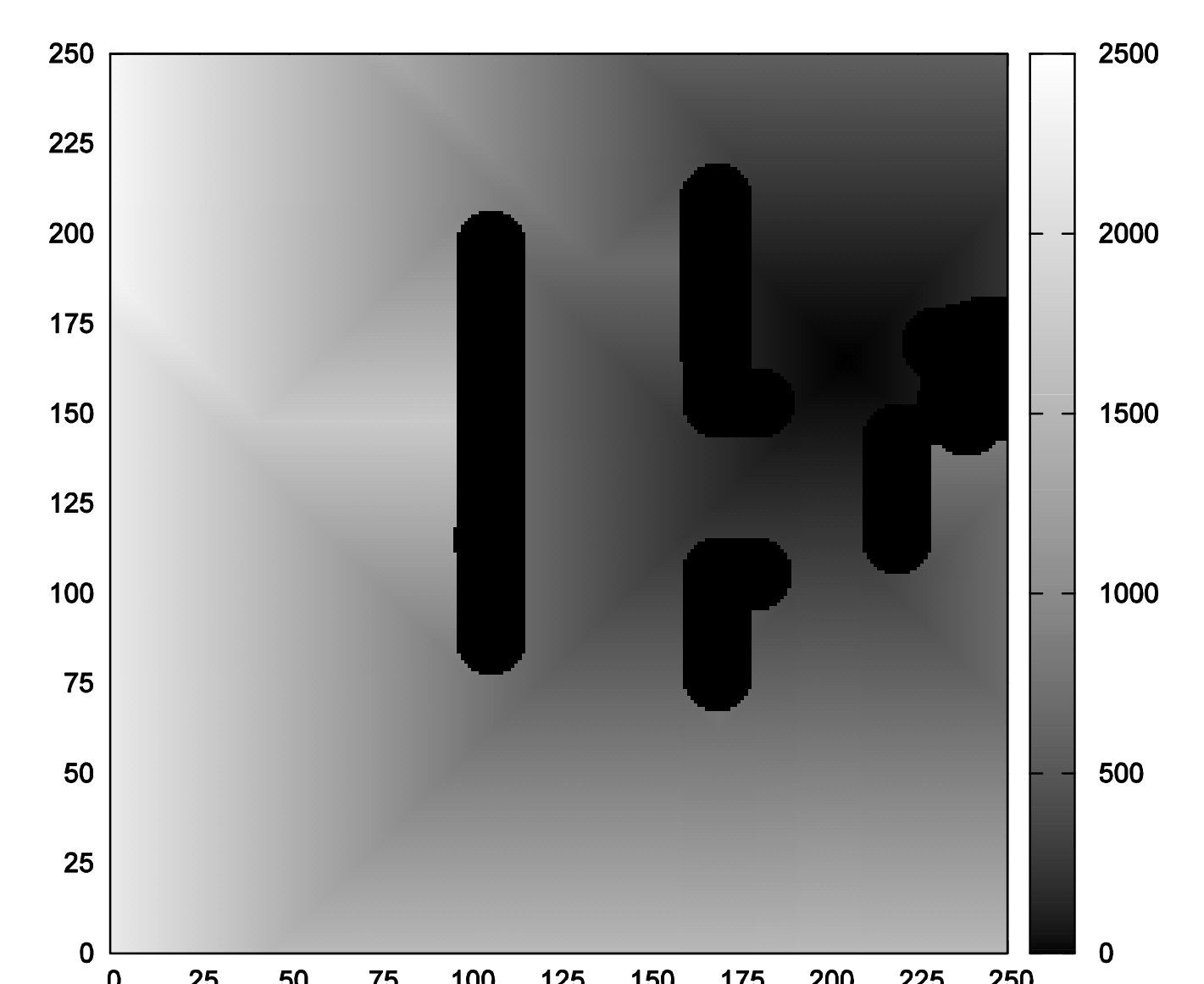
Recognized gesture translates to qualitative direction



Qualitative direction maps to target pose on Voronoi Graph and A* plans path in configuration space



A* search space is a discretized configuration space



Flood-fill heuristic computed from obstacle map guides A* search