DIS – Project
Multi-robot navigation in cluttered and dynamic environments
Group 8
December 19\textsuperscript{th}, 2018
Outline

- Procedure & Maps
- Experiences
- Hardware Implementation
- Conclusion
Outline

- Procedure & Maps
  - Experiences
  - Hardware Implementation
- Conclusion
Procedure

- Three algorithms tested
  - Reynolds
  - Evolutionary Algorithms
  - Graph based

- Experiences on five different static maps

- Best performing algorithm further developed
Procedure
Training maps (1/5)
Procedure
Training maps (2/5)
Procedure

Training maps (3/5)
Procedure

Training maps (4/5)
Procedure
Training maps (5/5)
Outline

- Procedure & Maps
- Experiences
  - Reynolds
  - Evolutionary Algorithm
  - Graph Based
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Experiences
Reynolds

- Cohesion
- Separation
- Alignment

- Braitenberg for obstacle avoidance
Experiences

Reynolds

Evolution of the overall fitness score through time
Experiences
Evolutionary Algorithms

• Neural net architectures:
  • Simple neural net (no hidden units)
  • Multi-layer perceptron (7,4)

• Inputs/Outputs:
  • Every relevant inputs (relative positions, sensor inputs, etc...)
  • Outputs right and left motor speed ∈ [0,1]
Experiences
Evolutionary Algorithms
Experiences
Graph Based

• Three different implementations for obstacle avoidance:
  • Negative weights
  • Braitenberg weights
  • State machine

Sources: Falconi, R., & Gowal, S. (2009).
Experiences

Checking the formation
Experiences
Graph Based
Experiences

Graph Based
Experiences
Graph Based

Clearly the best performing algorithm
Experiences Crossing

Crossing performance flock 1 (left side of the map)

Crossing performance flock 2 (right side of the map)
Experiences
Scaling up

Evolution of the overall fitness score through time

- graph_based_rb
- graph_based_rb_8_robots

Overall fitness [-]
Time step [-]
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Hardware

Full implementation
Hardware Flocking
Hardware
Obstacle avoidance
Hardware

1 vs 1 Crossing
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Conclusion

- Over all acceptable performances in simulation
- Hardware is tricky
- Possible improvement
  - EKF instead of odometry
  - Formations
  - Communication protocols
  - More robust hardware


Thank you

Any questions?