R E V I S E D   A B S T R A C T

Master Thesis Defense

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Title:	Evacuation of Equilateral Triangles by Mobile Agents of Limited Communication Range
Date:	Tuesday, December 10, 2019
Time:	10:00
Place:	EV 2.184

ABSTRACT

We consider the problem of evacuating $k \geq 2$ mobile agents from a unit-sided equilateral triangle through an exit located at an unknown location on the perimeter of the triangle. The agents are initially located at the centroid of the triangle. An agent can move at speed at most one, and finds the exit only when it reaches the point where the exit is located. The agents can collaborate in the search for the exit. The goal of the *evacuation problem* is to minimize the evacuation time, defined as the worst-case time for *all* the agents to reach the exit.

Two models of communication between agents have been studied before; *face-to-face communication* model and *wireless communication* model. In the former model, agents can exchange information about the location of the exit only if they are at the same point at the same time, whereas in the latter model, the agents can send and receive information about the exit at any time regardless of their positions in the domain. In this thesis, we propose a new and more realistic communication model: agents can communicate with other agents at distance at most *r* with $0 \leq r \leq 1$.

We propose and analyze several algorithms for the problem of evacuation by $k \geq 2$ agents in this model; our results indicate that the best strategy to be used varies depending on the values of *r* and *k*. For two agents, we give four strategies, the last of which achieves the best performance for all sub-ranges of *r* in the range $0 \leq r < 1$.

We also show a lower bound on the evacuation time of two agents for any $r < 0.336$. For $k > 2$ agents, we study three strategies for evacuation: in the first strategy,

called **X3C**, agents explore all three sides of the triangle before connecting to exchange information; in the second strategy, called **X1C**, agents explore a single side of the triangle before connecting; in the third strategy, called **CXP**, the agents travel to the perimeter to locations in which they are connected, and explore it while always staying connected. For 3 or 4 agents, we show that **X3C** works better than **X1C** for small values of *r*, while **X1C** works better for larger values of *r*. Finally, we show that for any *r*, evacuation of $k = 6 + 2\left\lceil \left(\frac{1}{r} - 1\right) \right\rceil$ agents can be done using the **CXP** strategy in time $1 + \frac{\sqrt{3}}{3}$, which is optimal in terms of time, and asymptotically optimal in terms of the number of agents.