**Crowd Simulation Background** (Why do crowd simulation):

The increasing urbanization of the world population presents new challenges for decision makers. Real-time crowd simulation is crucial in addressing these challenges, including determining evacuation times in complex buildings, avoiding overcrowded areas during mass events, and improving the crowd flow in cities. We are developing a simulation framework with unique features that aim at realism, speed and accuracy. Our software is available for research and commercial use.

(Reference: <https://www.uu.nl/en/research/algorithms/computational-geometry/research-themes/crowd-simulation>)

Crowd and multi-agent simulation is the process of simulating large numbers of people, creatures, or other characters, each interacting in one environment. These actors are expected to move to their goals, interact with their environment, and respond to each other. Crowd simulations have many uses, including improving architectural planning, enhancing training environments and virtual realties, and driving artificially intelligent (AI) characters in games and movies. Our group has worked on many problems in crowd simulation, including fast, guaranteed, collision avoidance, real-time path and motion planning, crowd flows, and directed behaviors. See also our related work in ([motion and path planning](http://gamma.cs.unc.edu/research/robotics/)) for single and multiple robots or agents.

(Reference: <http://gamma.cs.unc.edu/research/crowds/>)

==============================================================================

**Existing approaches (others’ works)**:

[May or may not have features in common]

Walk Along steering for navigating a couple of agents to reach a certain place together. The results of a believability study with 26 human subjects who compared the new steering to the known Leader Following steering in eight different scenarios suggest the superiority of the Walk Along steering in social situations. (from Abstract Malostranské nám)

< ***When a Couple Goes Together: Walk along Steering*** >

The algorithm is composed of three phases:

1) perception of agents and obstacles through the peripheral vision of the agent setting up a list of neighbors and time contacts;

2) building ranges of available speeds and orientations;

3) discretization of ranges, finding the best combination considering a heuristic function about energy consumption, deviation angle and risk of collision.

< ***Prediction in Social Path Following*** >

Problem Descriptions:

The main objective of this work is to introduce online learning techniques in multi-agent navigation so that the agents can exhibit a more intelligent collision avoidance behavior. In a typical multi-agent navigation problem, we are given a virtual environment containing static obstacles and n heterogeneous agents Ai (1 ≤ i ≤ n) with specified start and goal positions. The task is then to steer each of these agents to its goal without colliding with the other agents and the obstacles present in the environment. We also require that the agents navigate independently without explicitly communicating with each other.

< ***Online Learning of Mutil-Agent Local Navigation*** >

What this paper do:

This paper presents a novel technique to design the agents to with following modules 1) Path planning behavior for collision avoidance 2) Situation awareness during herding behavior and turbulent flow in high density crowds. 3) Personal Reaction bubble (PRB) based response and perceptions. The evaluation with real life situations is performed to validate the RBAS model.

< ***Realistic Modeling of Agents in Crowd Simulations*** >

**Question**:

What unique feature(s) our project have?

How I verify my result?

**Abstract**

Current crowd simulation research could achieve “certain behavior”, researchers are more focus on develop walking behavior of single or pair agents. Unfortunately, their crowd simulation approach is lack of realism and flexibility because it does not involve complex behavior such as allowing agents to move in and out of different group or line based on agent’s desire. In order to create realistic and trustworthy crowd simulation result, we proposed new, sophisticated crowd simulation algorithm to achieve complex features such as agents in single/pair walking mode and queue up to form waiting lines in the scene to pass through gate to simulate event security checking. These crowd features are collected from various observations of real-life crowd videos recorded among different events.

**Introduction**

The increasing proportion of people living in urban areas brings new challenges to urban planning and architecture. Crowd simulation plays an important role in addressing these challenges. With the help of crowd simulation technique, urban designers or architect could determine the evacuation time of a massive crowd, detect the behavior of crowd flow inside the building and prevent overcrowded area during events. We are developing a simulation application which aim at creating realistic, unique and accurate crowd.

Previous work