Detecting Hostile Intent

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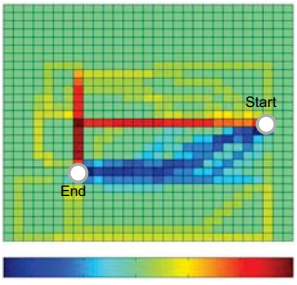
Introduction

We have been paying close attention to detecting concealed hostile intent, which probably is a key ingredient in terrorists' attacks. Movement can be used to detect hostile intent.

In studies of deception, deceivers exaggerate their behavior. They do the opposite of what they want to reveal, but they go too far, and their extreme behavior can be revealing.

Such deception studies have focused on facial movement, or on patterns of speech. In contrast, we are studying patterns of movement – coarse motion trajectories.



Study

Our focus this past year has been on the detection of two types of intrusion: diver attacks, and small boat attacks. We have made several significant advances this year.

In relation to small boat attacks, we have created a simulation environment based on a commercial video game. This environment makes it possible for players to take on roles.

Subjects can play as teams of attackers in small boats targeting a large ship. Their behavior will allow us to study hostile intent in movement patterns. Alternatively, subjects can play the role of ship defenders. The defenders can watch from the ship, or can assume control of patrol boats defending the ship's perimeter. 8

We provide the defender with a real-time detection algorithm which displays the probability of hostile intent and distance to the target.

The 3D game environment serves three purposes. It allows us to collect empirical data through human subject experiments in a realistic fashion, using both simplified and naturalistic scenarios. Second, it constitutes a training aid. Third, it gives us a platform on which to test automated decision aids.

Environments

The main environment we have worked on is a maritime scenario in a harbor, as shown in Fig. 1. Subjects have a first-person view in the environment.

The subject drives this boat. For example, the target ship might be the ship straight ahead with an American flag. Deceivers tend to use other ships and obstacles around the other ships to lie about the true target. The way they make sharp turns around the fake objects is a good indicator of deception.

The simulation environment is a multiplayer environment. This allows simultaneous attacks of a group of terrorists. We can have guards protecting the harbor.

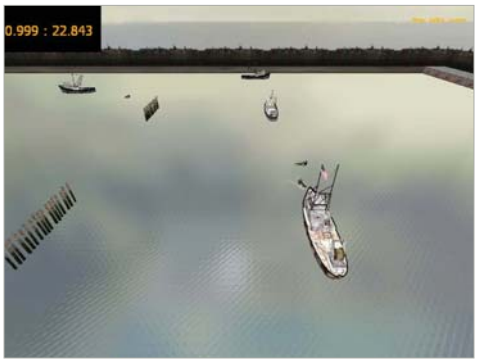


Fig. 3 – Top view of a terrorist attack

The presence of guards likely changes the behavior of the terrorists and creates new movement patterns to study. Guards may create events, and the response of the terrorists to the events may be useful for detecting intent. Some guards may patrol around the target ship to try to intercept an attacker.

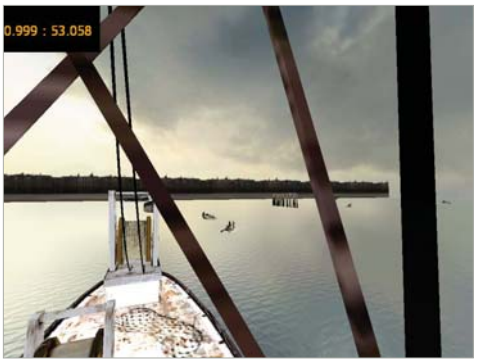


Fig. 2 - Viewpoint from bridge of target

We are exploring how guards may use the output of the detection algorithm we have developed previously, and how they may perform under different conditions.

We have been manipulating the number and type of ships and obstacles to make detailed comparisons of the deceivers' behavior and the behavior of normal.

Results

We have learned from the simulation environment that an asymmetric boat attack happens very quickly and having decision aids helps. Initial results suggest that placing obstacles too close to the target does not leave the guard enough time. Conversely, the deceiver will not use the obstacle when it is placed too far from the target. Our results will also tell us where to place obstacles to detect deceivers as quickly as possible. We have also started examining how to best train individuals to maximize their transfer ability in categorizing objects. We have been examining what information to put in a training aid. We are extending our work and designing human subject experiments to train individuals to recognize intent.

Future Evolutions

Using similar concepts we are building a transit hub environment (Fig 4). The transit hub environment is still in an early stage of development Results from this environment will be useful for understanding people's walking patterns in a variety of locations.

Fig. 1 - Attacker viewpoint

Fig. 4 – Airport Environment