Path analysis using geodesic active contours.

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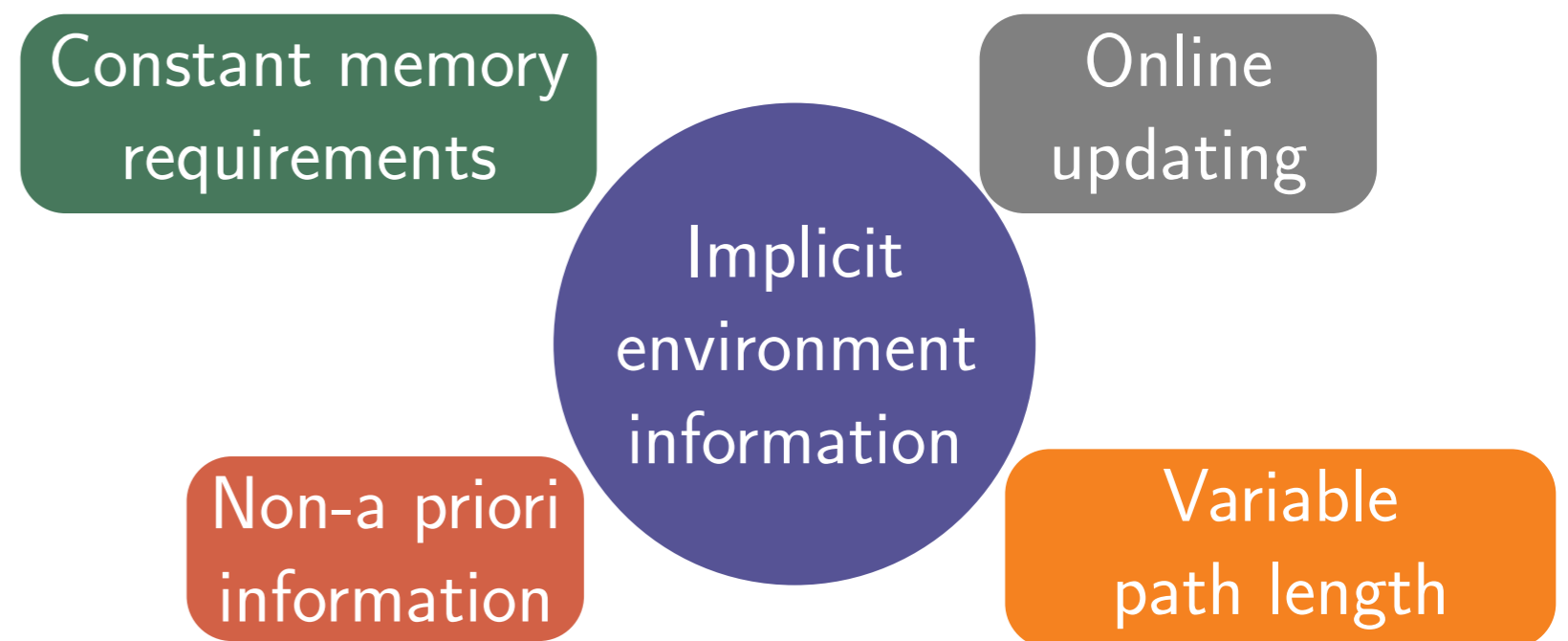VARPA Group, Department of Computer Science, University of A Coruña, Spain

Abstract

Path analysis is an important field of study in security environments. It is a powerful tool in behavioral systems, such as detecting abnormal behavior in targets with erratic movements, road analysis detecting traffic jams and possible escape routes. We present a new strategy for path analysis based in the idea of that a target tends to choose the path that takes less time to reach its goal, avoiding unnecessary huge deviations. Thus, the system can be modeled as a minimal path approach.
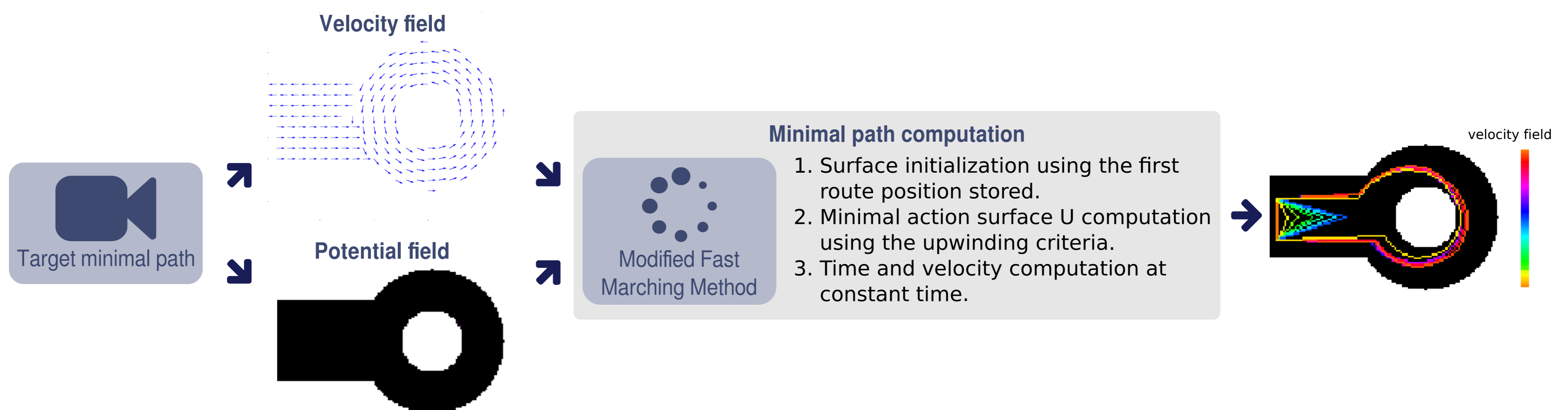
Path analysis

▸ Our model introduces insight about the human trajectory behavior from a computer vision point of view. Some hypothesis are presented, and a methodology that tries to refute them is presented.

▸ A modified Fast Marching Method is used to compute the average time and space needed to reach any position in the scene.

▸ Spatial and temporal metrics were created in order to detect whereas a target behavior is abnormal or not.

Advantages of minimal paths

Constant memory requirements · Online updating · Implicit environment information · Non-a priori information · Variable path length

Minimal Path Technique

Velocity field

Potential field

Target minimal path

Modified Fast Marching Method

Minimal path computation
1. Surface initialization using the first route position stored.
2. Minimal action surface U computation using the upwinding criteria.
3. Time and velocity computation at constant time.

velocity field

Traffic scene application

MINIMAL PATH RESULTS

Minimal path using directional forces performs a good solution when dealing with turnarounds

The algorithm is able to distinguish when a target behaviour becomes erratic in real time (A simple threshold can be used to distinguish between behaviors).

MAIN ROUTE RESULTS

The algorithm provides information about the traffic usual routes in a parking lot.

The system is able to cope with usual, inusual and erratic movements.

Conclusions

▸ A new vision for path analysis using directional forces is provided.

▸ No clustering techniques are needed.

▸ Usual route can be computed at any given moment.

▸ Good results achieved both with and without information a priori about the environment.

▸ The methodology is able to cope with changes in the behavior along time.

▸ Experiments over crowded datasets show promising results.

References

[1] B. Cancela, M. Ortega, M.G. Penedo, J. Novo, and N. Barreira. On the use of a minimal path approach for target trajectory analysis. *Pattern Recognition*, 46(7):2015–2027, 2013.

[2] B. Cancela, M. Ortega, M.G. Penedo. Trajectory Similarity Measures using Minimal Paths. *Image Analysis and Processing–ICIAP 2013*, 400–409, 2013.

[3] B. Cancela, M. Ortega, M.G. Penedo.Unsupervised Trajectory Modelling using Temporal Information via Minimal Paths. *Computer Vision and Pattern Recognition–CVPR 2014*, to appear, 2014.

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