

# Abstract

When a hostile robot or agent navigates through an unobstructed area having obstacles, the ability to forecast its forthcoming movements or “*behaviour*” becomes crucial in mitigating potential security risks or other forms of threats posed by these entities. In order to forecast future movements, it is essential to monitor the open space through cameras equipped with a 360-degree or panoramic view, enabling vigilant observation of the agents’ activities and facilitating strategic planning in response. Traditional complex stochastic or machine learning models employed for predicting future states demand significant computational resources. This study introduces alternative techniques aimed at forecasting the “*behaviour*” of adversarial agents traversing freely within an environment, leveraging their current and past behavioral patterns. These techniques are tailored for implementation in low-power robots or devices, where deploying costly stochastic or machine-learning models may not be feasible. Diverging from the prevalent literature that relies on temporal predictions, these methods forecast future states based on the system’s current states. Moreover, they are adaptable to scenarios involving both singular and multiple-looped paths followed by the adversary robot.

Considering the 360°/panoramic perspective of camera coverage resembling circles, this study demonstrates that positioning circles to encompass the open space within environments containing convex and concave polygons presents an NP-complete problem. The expanse of the open space requiring coverage far surpasses the area that a single circle can encompass. Hence, the strategic arrangement of circles within the open space becomes crucial. This work offers an approximate solution for strategically situating overlapping circles within the open space. The methodology aims to minimize the overlap between polygons and these circles as much as possible. A heuristic method based on a Genetic Algorithm is also proposed to cover the free space of an environment containing convex polygons with circles, ensuring that the overlap between placed circles and polygons stays within a predetermined value and

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that no overlap occurs between the placed circles.

In this proposed approach, following the placement of a circle, the environment undergoes adjustments to designate the circle's area as occupied space, thus preventing redundant coverage by subsequent circles. This approach hinges on an additional proposed method for generating a planar subdivision graph in a given environment. This method involves dynamically adding or removing polygonal obstacles, akin to the regeneration of a map following a natural disaster.