Path Planning Inspired on Emotional Intelligence

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Abstract. This chapter is focused on how emotional intelligence is used in order to plan the most suitable path for a robot when fulfilling a certain task. Classic planners use several criteria such as the shortest path, or the minimum time, but those planners do not take into account some inner factors as human beings do in the decision making process. Those factors are for instance, previous experiences that led to failures or successes as well as inner factors that can determine the fact that sometimes people are more conservative or more brave when selecting a path to reach to some place. In this chapter, a general view of robot planning as well as the role of emotions in robots are exposed first. Moreover, an example of an emotion inspired planner applied to a topological navigation system is shown, as well as the results obtained with a real robot.

6.1 Introduction

The path planning in robotics involves the knowledge and modeling of the environment as well as certain criteria for selecting the best path. In order to tackle this problem, some basic concepts related to the robot navigation are going to be described. Next, the role of emotions in the decision making process will be stated and later, the topological modeling of the environment will be introduced as the natural way of representing the environment. Finally, a planning algorithm inspired on emotions will be presented as an example. This algorithm is derived from another known algorithm, the Dijkstra algorithm. Making some modifications in the cost function of the Dijkstra algorithm the proposed “Guided Dijkstra” is obtained. This new algorithm tries to imitate one of the most common human behaviour of selecting longer but more familiar routes, minimizing the chance of getting lost. Differing from other similar research, as that one carried out by Roy [17], the chosen path here will depend on the previous navigation actions (past experiences) and on the successful or failed actions that the robot carried out (positive or negative reinforcement). This fact implies that the selected path will not be established a priori.

6.2 The Path Planning Problem

As part of everyday life, people navigate from one place to another using their knowledge about the environment. This is a natural process people learn in their childhood.
and develop as they grow up. But how do people find their ways? Usually most of the computer models do not simulate the behaviour of human wayfinders.

Researches in topological navigation in the last years tend to separate two problems that were before considered as one: path planning and wayfinding. The first one groups together problems related with obstacle avoidance until a defined point is reached. The second one is the task sequencing at higher level. This one can lead in a final event that does not necessarily have to be a specific geometric point.

The path planning problem in a first approximation, can be divided in two tendencies. The first one, considered as the classic one, assumes the environment’s total geometric knowledge. The second one, based on the sensorial information, considers the lacks that are linked to the real information obtained of what surrounds such as: partial knowledge, sensor failure, obstacles that do not allow total vision, unexpected situation, etc. Within this field, all the classical avoidance techniques are found, as those based in potential fields or the use of maps based on reticular occupation.

In relation to the wayfinding problem, planning movements from an initial place to a final one trying to imitate the human behaviour, researchers in the field of spatial knowledge have the same overall vision of the problem by layers. Timpf and Volta establish 3 levels: The planning level, the instruction one and the guidance behaviour one. Based on the navigation model that focuses on the mental or cognitive map, these researches consider that it is through this mental map how the following task is accomplished: the task of obtaining verbal instructions to indicate paths, navigation and environment description.

Some other research lines, such as those of Chatila, and Firby, are found. Both consider the planning in a high level of deliberative type. Chatila considers a more extended planning hierarchy, in which it is established that the planning concept can be divided into path and movement planning, perception planning, navigation planning, manipulation planning, communication planning, and task planning.

6.3 Emotions in Robotics

One of the main objectives in robotics and artificial intelligence research is to imitate the human mind and behaviour. For this purpose the studies of psychologists on the working mind and the factors involved in the decision making are used. Several psychologists have realized the importance of the emotions in the intelligent thinking and behaviour. In fact, it has been proved that two highly cognitive actions are dependant not only on rules and laws, but on emotions: Decision making and perception. Moreover, some authors affirm that emotions are generated through cognitive processes. Therefore emotions depend on ones interpretation, i.e. the same situation can produce different emotions on each agent, such as in a football match. Moreover, emotions can be considered as part of a provision for ensuring and satisfaction of the system’s major goals. Emotions play a very important role in human behaviour, communication and social interaction. Emotions also influence cognitive processes, particularly problem solving and decision making.