Development of Sensory Fusion Algorithm for 3D Object Identification in Uncertain Environments

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by

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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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I endorse the declaration by the candidate.

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Abstract

Soft computing techniques derived from artificial intelligence (AI) have been used for complex problem domains successfully. Moreover the Fuzzy Logic (FL) is being used for handling uncertainties in the problem space and the Neural Networks (NN) is being using for modeling an unknown target system that is described by a set of input-output data pairs.

The 3D object identification and modeling has been an interesting research area among researches since it has a great deal of exciting applications such as pattern understanding and recognition, representing the real environment for visual navigation, constructing virtual environment for virtual reality system and applications, modeling and identification of unknown environments.

Object identification when considerably uncertain information is provided has been a challenging task for researches specially when using low cost cameras and unreliable sensors such as Sonar range finders. This turns out that fusion of these sensors appropriately will eventually lead to a better result than considering individual sensors. The use of soft computing techniques for resolving problems in such complex problem domains is successfully practiced by many researchers.

The research mainly focused on identification of symmetric objects such as spheres, cubes, cones, pyramids, cylinders etc when the problem space information is not certain. This involves using a hybrid system (Fuzzy Logics and Neural Networks) for reducing the uncertainties and improves the performance of the system. A low cost CCD camera and cheep sonar range finders are used for collecting the information on the objects. The outputs of the sonar sensors are filtered through fuzzy rule base to reduce the uncertainty of the distance information. Then the image and distance information are combined to construct the input array for a neural network. Then the system is tested with sample data which are not present in training the system.

Results shows attractive growth of performance when using sensor fusion approach for identifying the primitive type objects rather than using single sensor such as a CCD camera. Almost all objects are classified correctly with sensor fusion algorithm. This concludes that using sensor fusion algorithm based on hybrid systems (FL and NN) with relevant sensors gives better results than use of single sensor for primitive type object identification when uncertain and unreliable data are provided.

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