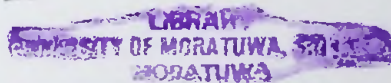


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Development of Sensory Fusion Algorithm for 3D Object Identification in Uncertain Environments

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
Degree of Master of Science



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.

UOM Verified Signature

D.D.A.S. Jayasiri
Date: 31/01/2006

I endorse the declaration by the candidate.

UOM Verified Signature

Dr. UKDLP Udawatta



Contents

Declaration	i
Abstract	v
Acknowledgement	vi
List of Figures and Tables	vii

Chapters

1. Introduction	1
1.1 The Visual Hull Concept for Image Modeling	1
1.2 Superquadric Based Object Modeling	3
1.2.1 Tapering Deformation	4
1.2.2 Twisting Deformation	5
1.2.3 Bending Deformation	5
1.3 The Object Identification in Uncertain Environment	6
1.4 The Sensors Used for Object Identification and Modeling	7
1.4.1 The CCD Camera	7
1.4.2 The CMOS Camera	9
1.4.3 The Sonar Range Finders	10
1.4.4 The Laser Range Finders (ladar)	11
1.5 The Proposed Methodology	12
2. Data Collecting and Preprocessing	13
2.1 Image Information	13
2.1.1 The Collection of Images from Primitive Type Objects	13
2.1.2 Gray Scale Conversion	16
2.1.3 Extraction of Pixel Information from Grid Points	16
2.1.4 Constructing the Image Input Array	17
2.2 Distance Information	17
2.2.3 Validation Methodology for Sonar Sensor	17
2.2.4 The Two Dimensional Sonar Sensor Array	18
2.2.5 Preprocessing of Distance Data	19

3. Neural Networks and Fuzzy Logics for Mimic Natural Intelligence	20
3.1 Neural Networks	20
3.1.1 Activation Functions of Neural Networks	22
3.2 Fuzzy Logics	24
3.2.1 Membership Functions	24
3.2.2 Fuzzy Rule Based Inference	26
4. Sensor Fusion Algorithm	27
4.1 Sensor Fusion by Multiple Sensors	27
4.1.1 Complementary Sensors	27
4.1.2 Competitive Sensors	28
4.1.3 Cooperative Sensors	28
4.1.4 Distance Information	29
4.1.5 Image Information	29
4.2 The Intelligent Sensor Fusion Algorithm	30
4.2.1 Reduction of Uncertainty by Fuzzy Filtration	30
4.2.2 Combining with Image Information	32
4.2.3 The New Input Array and Neural Network Classifier	33
5. Robotic Platform and Sensors	34
5.1 The Robotic Platform	34
5.1.1 The OOPic-R Controller Board with the OOPic2+ Firmware	34
5.1.2 The Basic Plat Form	35
5.1.3 The Integrated Robotic Platform	36
5.2 The vision Sensor	37
5.3 Sonar Range Finder	38
5.4 The Microcontroller and Serial Data Transmission	40
6. Robot Navigation	42
6.1 The Robot Navigation Simulation	42
6.1.1 Avoid Obstacles Layer	43
6.1.2 Wonder Layer	43
6.1.3 Goal Reach Layer	43
6.1.4 Work Usefully Layer	43
6.2 Defuzzification	45

7. Results	46
7.1 The classifier performances with out sensor fusion	46
7.1.1 Input Array of 35 Elements	46
7.1.2 Input Array of 63 Elements	47
7.3 The Classifier with Data by Both Sensors without Filtering	48
7.4 The Classifier with Fusion of Data by Both Sensors with Filtering	50
7.6 The Simulation Results form the Robot Navigation	53
8. Conclusions	54
References	56
Appendices	59
Appendix A: The Fuzzy Logic Codes	59
Appendix B: The Neural Network Codes	62
Appendix C: Codes in the Microcontroller	66



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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List of Figures and Tables

Figure	Page
Figure 1.1: The intersection of silhouette cones	2
Figure 1.2: Deformable superquadric surfaces with different parameters	5
Figure 1.3: A specially developed CCD	8
Figure 1.4: The CMOS camera	10
Figure 1.5: Principle of an active sonar	10
Figure 2.1: Image preprocessing stages	13
Figure 2.2: Some primitive objects used in the research	14
Figure 2.3: Different poses of the objects	15
Figure 2.4: The 35 selected grid points of the image	16
Figure 2.5: Validation method of the sonar sensor	18
Figure 2.6: The sonar sensor array	18
Figure 2.7: The distance measuring by sonar sensor array	19
Figure 3.1: A neuron model	21
Figure 3.2: The activation functions of various types	22
Figure 3.3: Fully connected Feed forward neural network	23
Figure 3.4: Fuzzy membership functions	24
Figure 3.5: Fuzzy membership functions for premise parameters	25
Figure 3.6: Fuzzy membership functions for consequent parameters	25
Figure 3.7: Block diagram of a fuzzy inference system	26
Figure 4.1: The approximately same view of different objects	28
Figure 4.2: Untrained membership functions of the antecedent	31
Figure 4.3: Untrained membership functions of the consequent	31
Figure 4.4: The Tsukamoto type fuzzy inference system	31
Figure 4.5: The new input array	32
Figure 4.6: The Classifier with proposed sensor fusion algorithm	33
Figure 5.1: The robot controller	35
Figure 5.2: The basic platform	35
Figure 5.3: The integrated robotic platform	36

Figure	Page
Figure 5.4: The CMU cam	37
Figure 5.5: Divantech SRF04 Sonar Range Finder.	38
Figure 5.6: Timing Diagram of SRF04 Sonar Sensor	39
Figure 5.7: The beam pattern of the SRF04	39
Figure 5.8: PIC16F877A Microcontroller pin arrangement	40
Figure 5.9: Interfacing Sonar Module to host computer	41
Figure 6.1: The subsamtion architecture with behavioral fusion	42
Figure 6.2: Block Diagram of Used Fuzzy system for obstacle avoidance	43
Figure 6.3: Untrained membership functions of Input	44
Figure 6.4: Membership of Output. Velocity of two wheels	45
Figure 7.1: The 35 input neural network	46
Figure 7.2: Network error graph without sensor fusion	47
Figure 7.3: Network error graph without sensor fusion	48
Figure 7.4: The classifier architecture with both data without filtering	48
Figure 7.5: Network error graph with sensors without filtering	49
Figure 7.6: The architecture of the proposed sensor fusion classifier	50
Figure 7.7: Network error graph with sensor fusion and filtering	51
Figure 7.8: Network error graph with sensor fusion and filtering	51
Figure 7.9: Robot simulation results	53
Figure 8.1: The scale invariance	54
Figure 8.2: The complex object	55

Table	Page
Table 7.1: The performances of various classifiers	52

