

# Project Title: On-line novelty detection and land-mark recognition

Degree Scheme for which the project is applicable:

DSP  PMRC  SSC

Industrial Support: Yes  No

First Supervisor: Dr. P Angelov Second Supervisor: Mr. X.-W. Zhou

### Project Description:

A number of important tasks in robotics such as *landmark recognition, self-localization, novelty detection, navigation* (wall following, obstacle avoidance) etc. require computational intelligence (neural networks, fuzzy logic controllers, rule-based classifiers, clustering etc.).

In this project **computational intelligence** algorithms will be studied and applied to real robots (Pioneer-3DX available in the Intelligent Systems Research Laboratory of the Department). New algorithms will be developed in Matlab and C++ (ARIA – C++ based set of packages used by Pioneer-3DX). Experimental work will be conducted on the robot simulator and in real environment (in and out of Infolab). The following problem will be addressed Robot exploring unknown environment recognizes landmarks and classifies them without any pre-training, any prior knowledge, and any communication link (GPS etc.) using motor and sonar sensors and on-board PC only.

**This work is novel, and presents an opportunity for research publication and potential interest from companies (QinetiQ).**

Skills required: Adaptive filters, Neural Networks, Fuzzy logic, on-line subtractive clustering, programming in C++, Matlab

### References:

1. Pioneer-3DX, User Guide, ActiveMedia Robotics, Amherst, NH, USA, 2004.
2. Jun L., T. Duckett, Learning Robot Behaviours with self-organizing maps and radial-basis functions Neural Networks, *Proc. SWAR'02*, 2002.
3. P. Angelov, X.-W. Zhou, Evolving Fuzzy Classifier for Real-time Novelty Detection and Landmark Recognition by a Mobile Robot, In *Mobile Robots: The Evolutionary Approach* (N. Nedja, L. Coelho, L. Mourelle Eds.), Studies in Computational Intelligence Series, Springer, March 2007, pp.95-124, ISBN 978-3-540-49719-6.
4. Zhou, X., P. Angelov, An Approach to Autonomous Self-localization of a Mobile Robot in Completely Unknown Environment using Evolving Fuzzy Rule-based Classifier, *First 2007 IEEE International Conference on Computational Intelligence Applications for Defense and Security*, April 1-5, 2007, Honolulu, Hawaii, USA, to appear
5. Zhou, X.-W., P. Angelov, Real-Time joint Landmark Recognition and Classifier Generation by an Evolving Fuzzy System, *2006 IEEE World Congress on Computational Intelligence*, Vancouver, BC, Canada, July 16-21, 2006, pp.6314-6321, ISBN 0-7803-9489-5.

Supervisor Signature.....

Student Signature.....