

The NUbots' Team Description for RoboCup-2003

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1. Statement of research interests

The NUbots are working on several research projects related to robotics, machine learning, and control theory:

- (a) Vision, object recognition, horizon determination, ellipse fitting, edge detection, see e.g. [1,3].
- (b) Localisation, Kalman filters, see [1,2].
- (c) Locomotion, evolutionary algorithms, robot simulators, biorobotics.
- (d) Methods for fault detection, neural networks, support vector machines, novelty detection [4].
- (e) Reinforcement Learning, obstacle avoidance.

2. Proposed approach

The NUbots' approach to the RoboCup challenge for 2003 is a significantly revised version of the successful 2002 approach (see [1]). Many details are currently improved based on results of the projects listed above.

3. Background of the principal investigators

Prof. Rick Middleton (Team Leader) has published research results in a range of areas including electric machine control, adaptive control, robot control, digital control systems theory using delta operators, multirate and sampled-data systems, performance limitations in feedback control systems (including multivariable and nonlinear systems), metal rolling control problems, robotics. He is co-author of the text "Digital Control and Estimation: A Unified Approach" (Prentice-Hall). He has been involved in industrial applications of systems and control to radio astronomy, satellite tracking, metals processing industries, power electronic inverter controls and various applications of Kalman filtering. He has served as an associate editor of both the IEEE Transactions on Automatic Control and the IEEE Transaction on Control System Technology. He is an Associate Editor of Automatica and is Director of the Centre for Integrated Dynamics and Control (A Commonwealth Special Research Centre).

Dr. Stephan Chalup is lecturer in Computer Science and Software Engineering. His background is machine learning, mathematics and neurobiology. He has published in several areas including neural networks, evolutionary computation, incremental learning, learning of formal languages, and robotics. He is leader of the Interdisciplinary Machine Learning Research Group at the University of Newcastle.

4. Description of the team organization and effort

In addition to the two academic principal investigators the team consists of several developers. The developers are all students in the School of Electrical Engineering and Computer Science at the University of Newcastle: Michael Quinlan (PhD student), Oliver Coleman (Honours student), Michaela Freeston (Undergraduate), Craig Murch (Undergraduate), Chris Seysener (Undergraduate), Graham Shanks (Undergraduate).

5. Pointers to relevant publications

Links to the NUbots' publications can be found at <http://robots.newcastle.edu.au/>

- [1] S. Chalup, N. Creek, L. Freeston, N. Lovell, J. Marshall, R. Middleton, C. Murch, M. Quinlan, G. Shanks, C. Stanton, and M.-A. Williams. *When NUbots Attack! The 2002 NUbots Team Report*. EECS Tech. Report.
- [2] Leonie Freeston, Rick Middleton. *Localization and World Modelling*.
- [3] William McMahan, Jared Bunting, Rick Middleton. *Vision Processing*.
- [4] Michael Quinlan, Craig Murch, Rick Middleton, Stephan Chalup. *Traction Monitoring for Collision Detection with Legged Robots*. in preparation.

6. Statement of commitment to enter RoboCup-2003 in Padova, including travelling expense and registration fee for participation

The NUbots are committed to enter RoboCup-2003. Their travel and registration expenses will be covered.

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