

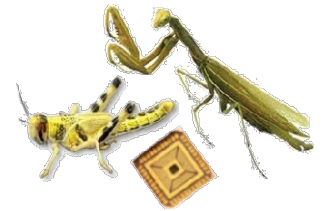
LIVCODE: Life like information processing for robust collision detection

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Final Report

PROJECT SUMMARY



The focus of this project has been on collision detection, an area which is critical for future mobile robots, ground and aerial vehicles. The primary objective of this project is to build international capacity and cooperation in the field of biologically inspired visual neural systems, via software simulation and hardware realization, to explore robust solutions for visual-based collision detection.

To be able to detect collision efficiently is of vital importance for the survival of animals that are migrating at speed, especially for those flying in dense swarms like locusts. Vision plays a critical role in collision detection for most animal species in a dynamic world. It is expected that in future, many human made machines, such like ground vehicles, mobile robots, and unmanned aerial vehicles (UAVs), should all be able to detect and avoid collisions effectively as animals do. The challenge to achieve this is huge. Biological visual neural systems provide ideal models to achieve this goal. The powerful parallel computing capacity of visual neural systems can be fully demonstrated and utilized when realized in Very Large Scale Integrated (VLSI) chips.

Realizing biologically visual system models in VLSI chips demands multidisciplinary expertise - in biological system modelling, multiple neural sub-systems coordination, computer vision and VLSI design. This breadth of expertise is not readily possessed within one institution. Research staff exchange is the best option to bridge neural system modelling and VLSI chip design via knowledge transfer between partner institutions. The staff exchange program is also the best way for the involved partners to build up strong expertise in this exciting multidisciplinary research area.

This consortium has focused on robust solutions for visual based collision detection during the project period. Taking the inspiration from biological visual systems, the consortium has brought neurobiologists, neural system modellers, chip designers, and robotic researchers from Europe and the fast growing East of Asia together, and complemented each others' research strengths via staff secondments, and jointly organised seminars and workshops. The consortium has investigated robust solutions for collision detection in the real world, through neural system modelling, neural model integration, chip realization and application. These activities have also helped to build strong connections between the European institutions and partner institutions in the East of Asia in the past four years since Oct. 2012.

In the research and development side, five work packages (WPs) have been designed to achieve the objectives of the project - WP1: Collision sensitive visual neural system modelling; WP2: Multiple visual neural systems coordination; WP3: Robust neural vision chip design; WP4: Collision avoidance systems for mobile robots and unmanned aerial systems; WP5: Project management, dissemination, and exploitation.

Through out of the whole project time, the involved partners have been working together via staff secondments, jointly organized workshops, training seminars and short visits etc every opportunity to achieve the project targets and consolidate the research collaboration between partners. Those involved researchers including ERs and ESRs have demonstrated excellent ability to contribute to the innovation and new knowledge creation in the related multiple disciplinary fields. Most of the planned activities such as workshops, and training seminars have been carried out during the four years period. The planned secondment activities have been actively promoted in the second phase and almost reached the initially planned target in terms of seconded researcher months. In total, the consortium has organized eight workshops, two training seminars, and has carried out most of the planned researcher-months secondments. As one of the outcomes of this project, the strengths of involved EU beneficiaries have been enhanced significantly and expanded covering these multidisciplinary fields. The research links between those involved partners have been further consolidated which will for sure bring about new collaborative research projects and outcomes.

PROJECT LOGO, IMAGES AND WEBSITES

This **image** in the right side of this paragraph is used as LIVCODE project icon. The project logo has been used in all the website, invitation letters, research posters, and workshop/conference presentations that are relevant to the project.



The LIVCODE project training workshop held in Lincoln (18/02/2015) where attendees were chip designers, neural system modellers and robotics researchers from TU, UoL, & XJTU.

Project websites: <http://www.ciluk.org/livcode.html> and <http://webpages.lincoln.ac.uk/syue/details/livcode.html>