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A robot in every home?

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Dr Nick Hawes

“A robot in every home. It sounds like a dream, but in the **Intelligent Robotics Lab (http://www.cs.bham.ac.uk/research/groupings/robotics/)** in the School of Computer Science we are working to make this a reality.

According to the**International Federation of Robotics (http://www.ifr.org/)**, two million robots were sold for domestic use in 2010, and they expect a further 14 million units to be added to this by 2014. These robots typically do one thing, and one thing (reasonably) well: vacuuming your floor, cutting your lawn, or cleaning your pool -- should you be lucky enough to have one. The advances that have led to these sales are the ones we're used to in technology: smaller, faster, lighter, cheaper. However, to achieve the dream of having a robot that you can ask to find your car keys, make the bed, put your shopping away or feed the cat, these advances are not enough; we need to make robots *smarter*.

This is where the IRLab comes in. Together with collaborators across Europe we're working to add advanced artificial intelligence (AI) techniques to robots to allow them to solve the kinds of everyday problems that humans find easy. Imagine asking a robot to find your favourite mug. While this sounds like a simple task for a human, it's incredibly difficult for a robot. They have to know what mugs looks like in general (as opposed to vases, jugs or jars) and what your mug looks like in particular; where mugs are generally kept and where you are likely to have left yours; and, above all, they have to be able to use this knowledge to move around your house (without getting lost, knocking things over or crushing your cat) using their sensors (lasers for measuring distance, cameras for observing the world) to actually find your mug.

It's this final part that makes robotics in the real world incredibly difficult. Humans find it trivially easy to translate light falling on to their retinas into a rich 3D world full of objects and people, Our abilities rely on perceptual abilities developed over evolutionary timescales and an intuitive, commonsense understanding of the way the world behaves. Providing these abilities to a robot is a major unsolved problem. Our work to address this problem is embodied by Dora and George, our prototype home service robots developed as part of the CogX project.

Dora has a system of drives which motivate her to act in intelligent ways. They cause her to explore her environment to discover more about it, building up a map she can use to work out where she is and find her way around. She can also be trained to recognise everyday objects like mugs, books and packaged food. She uses this ability to find things, but also to learn more about the world. For example, if she finds cereal and a kettle she will think she's in a kitchen. She can then put all this information together to search for objects. If you ask her to bring you some cornflakes, she will start looking for them in the place they're most likely to be (the kitchen) and also in locations where objects are usually found (shelves and worktops, rather than the floor).

George is a robot which can be trained interactively about new objects and their properties. You can show George objects and describe their properties (e.g. "the box is red", "that's a drinks can") and he will learn these and even use them to recognise objects in the future, asking you questions when he gets stuck (e.g. "can you tell me the name of that new red drinks can?").

By putting these advances together we will one day produce robots that can learn and adapt to their environments naturally, much as humans do; using what they learn to do useful jobs for their owners. This will bring the vision of a robot in every home one step closer.

Apply for the new MSc Robotics programme (http://www.birmingham.ac.uk/students/courses/postgraduate/taught/computer-science/robotics.aspx)

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