

Your robot helper is on the way now it can learn from its friends

20 January 2014, by Nick Hawes



I'll be right with you sir, just after I put this cup away. This is a cup, right? Credit: garrettc

January is a time when many of us seek to better ourselves. We want to learn a new skill or improve an existing one. A network designed especially for robots, [RoboEarth](#), is being tested in the Netherlands to help them with their attempts at self-improvement. Soon our mechanical friends will be able to swap tips on how to best care for us and learn about their worlds.

As demonstrated by [Google's recent purchase of robotics companies](#) and Amazon's [automated warehouses](#), intelligent, autonomous service robots are starting to look commercially viable.

Service robots are machines which can perform tasks with or for humans in normal environments (rather than in controlled factory settings). Intelligent, autonomous service robots have some freedom about how they complete tasks and need to make decisions about how to act based on what they know and can sense.

There are robots that can [make sandwiches](#), [find objects in your home](#), [do your washing](#) and even [assemble Ikea furniture](#).

Learning from scratch every time

When building systems such as these, one of the major bottlenecks is providing the robot with the knowledge about the world it needs in order to perform its task. This knowledge is usually centred around the objects involved in a task: what they look like, how they can be picked up or where they can be found. Knowledge about space (maps of buildings and rooms) and action (how to change the world to achieve a particular end) is usually essential too.

But robots have no built-in knowledge about these kinds of things. Everything they need to know must be engineered into their software somehow, such as by using [machine learning techniques](#) then connecting the results of this training to symbols within the robot's software to allow it to refer to the things in the world.

This knowledge engineering typically takes a huge amount of time for even a simple task and is usually limited in that the robot only ends up knowing about exactly the things you've taught it. For example, it might be able to recognise a box of Cornflakes, but not a box of Frosties, or perhaps not even a box of Cornflakes with different packaging.

This means that it is very difficult to just send a robot into a new environment, or ask it to perform a new task, without having a team of experts on hand to do this training. No-one can afford to ship a computer science PhD graduate with every robot so researchers around the world are looking at how robots can be equipped to quickly learn about a new environment when they are put in one.

Learning from robot friends

RoboEarth – a collaboration between universities and Philips – has developed an approach to this based on the ability to share knowledge over the internet.

The system has been likened to a social network or a Wikipedia for robots as it allows the knowledge created for one robot to be shared with another robot, anywhere else in the world, via a shared, web-accessible database. When one robot in Germany learns what a toaster is and how it works, it can upload that information into the network. A robot in Japan which has never used a toaster before can then log in and learn how to recognise one.

To enable robots with different bodies and sensors to learn from each other, RoboEarth has an abstraction layer which allows shared information to assume common capabilities across all platforms. This is much like how a desktop operating system like Windows allows the same software to run on many different types of computers.

To allow robots to easily find the knowledge they require, the contents of the RoboEarth database are structured via an ontology. This describes each entry using logic which can be queried automatically and relates connected entries. So an oven will be listed as a type of household appliance and a mars bar as a type of food.

The [RoboEarth demonstration](#) is just the start of what will become an increasing trend of intelligent, autonomous machines sharing knowledge over the internet. While there are limitations to the current demonstrators, in terms of how well shared knowledge transfers across different systems and environments, we can expect this field to progress as robots begin to hit the market. The commercial need for robots to be able to learn from their peers will drive progress.

In the future it is easy to imagine both the current open protocols of RoboEarth educating robots worldwide, as well as a commercial alternative, like an app store, where robots and their owners can buy professionally engineered knowledge off the shelf. This will be a significant step towards the day when your morning orange juice or coffee will be

brought by a [robot](#) helper, or at least a step towards helping it to tell the difference between the two.

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