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2004 World Technology Awards Winners & Finalists

Prof. Roberto Cipolla and Prof. Duncan Robertson

Please describe the work that you are doing that you consider to be the most innovative and of the greatest likely long-term significance.

For a small fee, photo recognition software on a remote server works out precisely where you are, and sends back directions that will get you to your destination.

You are lost in a foreign city, you don't speak the language and you are late for your meeting. What do you do? Take out your cellphone, photograph the nearest building and press send.

For a small fee, photo recognition software on a remote server works out precisely where you are, and sends back directions that will get you to your destination. That, at least, is what two researchers at the University of Cambridge in the UK hope their software will one day be used for.

Photo positioning

Roberto Cipolla and Duncan Robertson have developed a program that can match a photograph of a building to a database of images. The database contains a three-dimensional representation of the real-life street, so the software can work out where the user is standing to within one metre.

Line of sight

This is far better than existing systems can manage. GPS satellite positioning is accurate to 10 metres at best, and can be useless in cities where tall buildings shield the user from direct line of sight with the satellites. And positioning using cellphone base stations has a precision of between 50 and 100 metres.

"Telling people 'You are in the vicinity of X' is no good to man nor beast," says John Craig of Cambridge Positioning Systems, a company that develops software for locating mobile phones.

Unlike the GPS or cellphone base station approaches, Cipolla and Robertson's software can tell which direction you are facing. So the service can launch straight into a set of directions such as "turn to your left and start walking", or give information on the building in the photograph.

When their system receives an image it begins by identifying vertical and horizontal lines. Next, it warps the image so that the horizontals are all parallel with each other, and the same for verticals. This transforms the picture into one that was taken square on, rather than at an angle.

Windows and doors

The software then looks for useful features, such as the corners of windows and doors, and extracts the colours and intensities of the pixels around them. Next, it searches the image database for matching data, using the base station the cellphone's signal

The 2005 World Technology Summit and Awards

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came from as a guide. Finally, it uses the differences between the two images to calculate the photographer's position.

The software can match two images even when they are taken at a different times of day, from different angles and with clutter such as pedestrians and vehicles in the way. "That's an easy problem for a human, but it's very difficult for a computer," says Robertson.

However, the system's commercial future is uncertain. "The question is: how much are people prepared to pay for it, and how often will they use it?" says Rob Morland, of technology consultants Scientific Generics near Cambridge. "That's a tough one."

For now, Cipolla and Robertson are optimistic. In March they received funding to start working on a prototype to cover all the buildings in Cambridge city centre.

James Randerson

(from http://www.newscientist.com/news/news.jsp?id=ns99994857)

Brief Biography

Roberto Cipolla obtained a B.A. (Engineering) from the University of Cambridge in 1984 and an M.S.E. (Electrical Engineering) from the University of Pennsylvania in 1985. From 1985 to 1988 he studied and worked in Japan at the Osaka University of Foreign Studies (Japanese Language) and Electrotechnical Laboratory, Tsukuba (visiting scientist) and he obtained an M.Eng. (Robotics) from the University of Electro-communications in Tokyo in 1988. In 1991 he was awarded a D.Phil. (Computer Vision) from the University of Oxford and from 1991-92 was a Toshiba Fellow and engineer at the Toshiba Corporation Research and Development Centre in Kawasaki, Japan. He joined the Department of Engineering, University of Cambridge in 1992 as a Lecturer and a Fellow of Jesus College. He became a Reader in Information Engineering in 1997 and a Professor in 2000. His research interests are in computer vision and robotics and include the recovery of motion and 3D shape of visible surfaces from image sequences; visual tracking and navigation; robot hand-eye coordination; algebraic and geometric invariants for object recognition and perceptual grouping; novel man-machine interfaces using visual gestures and visual inspection. He has authored 3 books, edited 6 volumes and co-authored more than 200 papers.

Duncan Robertson is a Research Associate in Cambridge University Engineering Department. He is in the Machine Intelligence Group in the Information Engineering Division. He is also a member of Downing College.

(from http://mi.eng.cam.ac.uk/research/vision/people.html)