Image Based Localization of Mobile Devices: Outdoors and Indoors

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Abstract
Pose estimation of mobile devices is useful for a wide variety of applications, including augmented reality and geo-tagging. Even though most of today’s cell phones are equipped with sensors such as GPS, accelerometers, and gyros, the pose estimated via these is often inaccurate. This is particularly true in urban environments where tall buildings block satellite view for GPS, and distortions in Earth’s magnetic field from power lines adversely affect compass readings. Furthermore in indoor environments, GPS signal is not readily available. In this talk, I describe an approach to image based localization for both indoors and outdoors. This is motivated by the fact that most of today’s cell phones are equipped with cameras whose imagery can be matched against an image database for localization purposes. Our approach consists of two steps. The first step, based on existing work, matches the query image from the cell phone against the image database in order to retrieve a database image of the same scene. The second step recovers rotation and translation via matching point feature correspondences between the query and database images. We characterize the performance of this approach for an outdoor dataset in Oakland, CA and show that for a query set of 92 images, our image based estimation of position is within 10 meters of ground truth for 91% of queries as compared to 31% for GPS on the cell phone. As for indoor localization, the key challenge is a way to develop indoor geo-tagged image database. We use the human operated backpack system made of sensors which was originally designed to generate textured, 3D models of building interiors to build a geo-tagged image database which can then be used for image based localization of mobile devices.

Biography
Avideh Zakhor joined the faculty at UC Berkeley in 1988 where she currently holds the Qualcomm Professor of Electrical Engineering and Computer Sciences. Her areas of interest include theories and applications of signal, image and video processing, 3D computer vision, and multimedia networking. She has won a number of best paper awards, including the IEEE Signal Processing Society in 1997 and 2009, IEEE Circuits and Systems Society in 1997 and 1999, IEEE Solid Circuits Society in 2008, IEEE international conference on image processing in 1999, Packet Video Workshop in 2002, and IEEE Workshop on Multimodal Sentient Computing in 2007. She holds 6 U.S. patents, and is the co-author of three books with her students. Prof. Zakhor received the B. S. degree from California Institute of Technology, Pasadena, and the S. M. and Ph. D. degrees from Massachusetts Institute of Technology, Cambridge, all in electrical engineering, in 1983, 1985, and 1987 respectively. She was a General Motors scholar from 1982 to 1983, was a Hertz fellow from 1984 to 1988, received the Presidential Young Investigators (PYI) award and Office of Naval Research (ONR) young investigator award in 1992. In 2001, she was elected as IEEE fellow and received the Okawa Prize in 2004. She co-founded OPC technology in 1996, which was later by Mentor Graphics (Nasdaq: MENT) in 1998, and UrbanScan Inc. in 2005 which was acquired by Google in 2007.