SAN DIEGO STATE UNIVERSITY

Mechanical Engineering
Faculty Candidate Seminar

Acoustic perception and unpredictable motion planning for intelligent physical systems

Thursday, January 30, 11am-12pm; EIS-320

Abstract: AI-driven technologies are without doubt transforming every aspect of our life. These systems are particularly instrumental in performing mundane or dangerous tasks for humans. An example of such tasks is surveillance and exploration of hazardous unknown terrains. To effectively perform these tasks, the mobile robot needs strong perception capabilities and intelligent motion planning strategies. In terms of perception, the sensory data should help the robot to extract useful information about the environment in any conditions, no matter how dark or cluttered the environment is. Among all types of perception systems, only the acoustic perception can fulfill this requirement without the need of being fused with other sorts of sensory information. Acoustic perception particularly outperforms visual systems in complex dark or cluttered environments. Yet, in spite of the great advances made in visual systems, today's robots have very basic auditory capabilities. This comes from lack of a strong sound source localization system which in turn results from insufficient knowledge about sound wave propagation in complex real-life environments. This seminar will discuss an ongoing research focusing on modeling sound wave propagation and localizing sound sources in different complex environments. In terms of robot's motion planning, the strategies should be established to satisfy the specific needs and goals of surveillance missions. In adversarial conditions where the intruders might attempt to interfere with the mission, the unpredictability in the robot's path might help it to avoid the intruders or escape their attacks and successfully cover the terrain to find the targets. One way to realize unpredictable motions is to use dynamical systems to impart chaos to the robot's controller. Chaos has a unique power in realizing unpredictable and at the same time deterministic path planning, impossible to achieve with other types of path planning methods.

Dr. Zahra Nili Ahmadabadi

BIO: Dr. Zahra Nili is an assistant professor in Mechanical Engineering Department and director of Dynamic Systems and Intelligent Machines Lab at Wichita State University (WSU). She holds a B.S. from University of Tehran, an M.S. from Tarbiat Modares University, and a Ph.D. from University of Quebec (École de Technologie Supérieure), all in Mechanical Engineering. Her Ph.D. work focused on sound source identification and mathematical modeling of dynamical systems. Dr. Nili's current research interests include acoustic perception, deep learning & sequence modeling, autonomous systems, cooperative robotics, and nonlinear dynamical systems. Dr. Nili is a primary investigator on Kansas NASA EPSCoR grant which focuses on building robots capable of precise detection of the maintenance issues in the space station using auditory perception. Dr. Nili is also the recipient of University Research/Creative Projects award on her research to develop online path planning strategies for autonomous mobile robots to explore unknown terrains.

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