USC University of Southern California

USC Viterbi School of Engineering

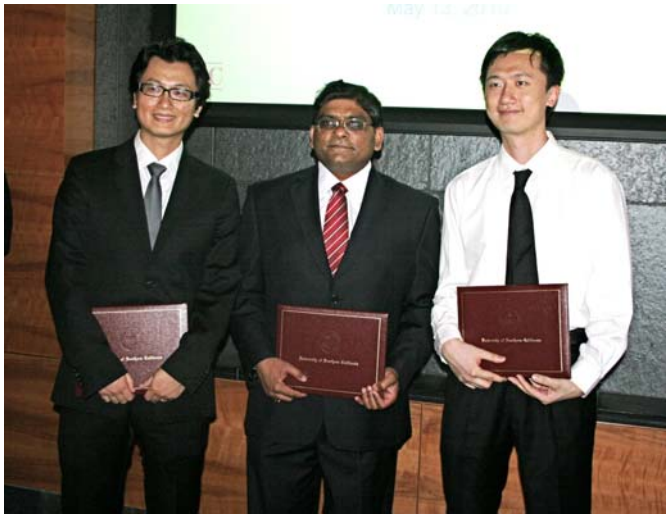
Viterbi School's 2010 Best Thesis Winners Worked with Comic Strips, Noise and Cardiac Disease

Jonghye Woo, Ashok Patel, and Jing Jin win awards for superior creative, theoretical and experimental research

May 14, 2010 —

Each year, the USC Viterbi School of Engineering recognizes three Ph.D. graduates for outstanding theses.

At graduation ceremonies on May 14, 2010, Viterbi Dean Yannis Yortsos congratulated the three winners, who were selected by a faculty committee.



Jonghye Woo, Ashok Patel, and Jing Jin at a reception honoring them at Ronald Tutor Hall on May 13, 2010.

Jing Jin of computer science won the best dissertation award for creative research. His thesis was entitled: “Interactive Querying of Temporal Data Using a Comic Strip Metaphor.”

Ashok Patel of electrical engineering won the best dissertation award for theoretical research. His thesis was entitled: “Noise Benefits in Nonlinear Signal Processing.”

Jonghye Woo of electrical engineering won the best dissertation award for experimental research. His thesis was entitled: “Variational Techniques for Cardiac Image Analysis: Algorithms and Applications.”

Jing Jin hails from Beijing, China. He settled on his thesis topic after reading the book Your Wish is my Command: Programming By Example, which was recommended by his advisor Pedro Szekely, a research professor at the Information Science Institute.

Many of the details of his thesis, Jin says, were hammered out in discussions with his wife. Eventually he settled upon the concept of using comic strip elements and syntax to specify and interpret temporal patterns within computer science problems.

In his thesis, Jin presented an interactive visual query environment (VizPattern) that can enhance the existing visualization systems by providing powerful temporal pattern analysis capabilities using a innovative visual temporal pattern language (QueryMarvel).

Mapping temporal elements and relationship into comic strip elements such as panels, characters and clocks convert highly abstract temporal pattern specifications into a concrete comic strip that everyone is familiar with. This allowed users to analyze temporal data more easily and with less error than with a state-of-the-art visual analysis system, says Jin.

Jin ran through each feature with his wife to make sure each approach was intuitive. Potential applications for his work include medical observational research, complex system debugging, financial event and values analysis, and consumer behavior tracking systems.

Jin wrote most of his thesis from a small office at ISI, and says he loved the experience but wished his office

had a window! His favorite memories of USC consisted of taking walks with his wife through campus after a long day. He also unwound by watching Friends reruns and playing ping pong.

Jing Jin won for his thesis, "Interactive Querying of Temporal Data Using a Comic Strip Metaphor."

"It was a very good way to relax," says Jin, who also favors movies by Michael Bay, director of the **Transformers** series, Pearl Harbor and Armageddon.

Jin is currently working at Google as a site reliability engineer. He received his bachelor's degree in computer science from Tsinghua University, and his Ph.D. in electrical engineering from the Viterbi School.

Ashok Patel hails from the state of Gujarat in western India, where he first nurtured his love for mathematics as well as hiking. While at USC, Patel determined that he was interested in working at the very forefront of nonlinear signal processing.

"That meant rethinking the nature of noise — when it's bad and, surprisingly, when it's good," says Patel, who appreciated the opportunity to work with Bart Kosko, his advisor and a leading researcher in noise.

The novel idea behind his thesis is that sometimes noise or uncertainty can benefit signal or information processing in many nonlinear systems. This "stochastic resonance" noise benefit occurs if the user judiciously introduces randomness or if the system exploits the noise already present in its local environment.

Patel formulated and proved new mathematical theorems and algorithms that let a user know if a signal system will benefit from noise and, if it will benefit from noise, how to find the best level of noise.

Potential applications of his research include enhanced artificial retinas, low-light imaging and night vision, infrared imaging and object detection, neural prosthetics, statistical diagnosis, and biometric systems. Patel's thesis itself included sophisticated applications to signal detection in radar, telecommunication, and digital watermark decoding.

Portions of his thesis research were published in leading peer-reviewed international journals such as the IEEE Transactions on Signal Processsing and the IEEE Transactions on Neural Networks. Several researchers have already cited and extended some of these results in the technical literature.

Patel's daughter Anika was born while he was working on his thesis, and he calls her an inspiration. His favorite writing spot was at home, with his wife nearby and Anika exploring underfoot.

In addition to his Ph.D. in Electrical Engineering from the Viterbi School, Patel has also earned three master's degrees: an M.S. in electrical engineering and an M.A. in applied mathematics, both from USC, and an M.E. degree in Electrical Engineering from Gujarat University. Ashok is currently working as a lecturer at the Viterbi School.

Jonghye Woo, a native of South Korea, says he has enjoyed life and work at USC tremendously. In the research laboratory, Woo was the first scientist to develop fully automated geometric feature-based multimodal image registration of contrast-enhanced cardiac CT with gated myocardial perfusion single photon emission computed tomography (SPECT). He was also the first scientist to develop accurate and automated co-registration of serial CCTA scans.

This allows voxel-wise comparison of coronary plaque composition, arterial stenosis and remodeling at two time points, which potentially allows for

Ashok Patel won for his thesis "Noise Benefits in Nonlinear Signal Processing."

direct quantitative monitoring of plaque changes.

His contributions to the field of image analysis application to coronary artery disease are original, of high significance, and have extremely unique applications in the field of cardiovascular imaging and science, says his thesis advisor, C. C. Jay Kuo, a professor of electrical engineering and computer science.

Jonghye Woo won for his thesis "Variational Techniques for Cardiac Image Analysis: Algorithms and Applications."

Woo's work in this area is leading to the generation of novel tools for diagnosis and treatment for cardiovascular diseases by novel registration techniques, which will be used in clinical practice.

His original discoveries were published in five internationally-circulated journals including the Journal of Nuclear Medicine, Medical Physics, Journal of Biomedicine and Biotechnology and Journal of Signal Processing System.

While at USC, he also enjoyed the opportunity to work in the laboratories of the Beth Israel Deaconess Medical Center in Boston and L.A.'s Cedars-Sinai Medical Center, where he worked to bridge engineering and medicine by applying mathematical optimization tools to the early diagnosis of life-threatening coronary artery diseases.

Woo says he'll miss most the daily impromptu discussions with fellow Trojans about research, religion and sports. During his studies, he unwound by watching movies, and his favorites are *Kung Fu Panda, The Kite Runner* and *The Shawshank Redemption*.

Woo received his B.S. degree from Seoul National University, and his M.S. and Ph.D.s from the Viterbi School. All were in electrical engineering. Woo is currently working as a research associate at Cedars-Sinai and will be seeking a faculty position.