Electrical & Computer ENGINEERING

ENERGY AND INFORMATION SEMINAR

eis.ece.cmu.edu

Monday, Sept. 29

Porter Hall
Room B34 at
12:30 p.m.

Yaoqing Yang
Carnegie Mellon Univeristy

Can a Noisy Encoder be Used to Communicate Reliably?

Yaoqing Yang is a second year Ph.D. student at Carnegie Mellon University. He received the B.S. degree from Tsinghua University, Beijing, China in June 2013. His research interests lie in the area of distributed function computing, with applications in network computing, noisy circuits and neural science.

Can a Noisy Encoder be Used to Communicate Reliably?

Inspired by Shannon theory's triumph over noise in communications, von Neumann initialized the study of noise in circuits in 1956. He showed that, even if all circuit components are noisy, it is still possible to bias the output towards the correct output value. Recently, Moore's law has made circuit elements extremely small, in the process reducing component reliability, bringing interest back in von Neumann's problem. Voltage variations, crosstalk, timing jitters and quantum effects can all jeopardize reliability. “Voltage-scaling” -- commonly used to reduce energy consumption -- can also introduce errors because of component variability at small sizes.

Bringing von Neumann's and Shannon's problems together, we ask: can one introduce noise in circuits that support communication? Focusing on the transmitter side, we investigate the question of whether reliable communication can be achieved with an encoder constructed from noisy components. Indeed, we provide an explicit encoder construction to do so. Interestingly, the key of the construction is to embed multiple noisy decoders *within the encoder* to repeatedly suppress errors. This core idea is also applicable to more general noisy computing problems, which I will also discuss if time remains.

ECE Energy and Information Seminar Hosts

Pulkit Grover <pulkit@cmu.edu>
Marija Ilic <milic@ece.cmu.edu>
Soummya Kar <soummyak@ece.cmu.edu>
José Moura <moura@ece.cmu.edu>
Rohti Negi <negi@ece.cmu.edu>
Aswin Sankaranarayanan <saswin@ece.cmu.edu>

Student Coordinator

June Zhang <junez@andrew.cmu.edu>

Electrical & Computer ENGINEERING

Carnegie Mellon University