Proposing math models to enhance two-way wireless network communication

February 10 2011

(PhysOrg.com) -- Natasha Devroye, University of Illinois at Chicago assistant professor of electrical and computer engineering, has won a five-year, $450,000 National Science Foundation Early Faculty Career Award to aid in her work analyzing communication flow by way of mathematical models.

Devroye is an information-theory expert who studies ways to help engineers design better communications networks for devices like cell phones, two-way radios and computers.

Her focus is modeling two-way exchanges of information over networks.

"I try to model wireless communication channels using a mathematical model, then use that to predict the ultimate limits of communication -- what you can ever hope to achieve in practice," she said.

While many think of such electronic exchanges as inherently two-way, Devroye said from an engineering standpoint they're usually treated as separate, one-way, back-and-forth exchanges.

"People are always communicating in a two-way fashion," she said. "But how that's modeled in math, or how the wireless networks are implementing this, is they're really treating the conversations we're having as a series of one-way conversations."

Devroye plans to build mathematical models that treat electronic two-

way communication systems -- such as data synchronization or cell phone conversations -- more like human conversations. These models will interactively adapt what, and how, such messages are encoded.

"Mathematically, if you can really capture two-way adaptation, what can you achieve?" she asks. Engineers would need a payoff for the time required to develop more complicated coding strategies. "I want to determine if there's going to be a huge gain or not."

Two-way schemes may improve data rates, increase reliability, or reduce the energy used to transmit data in wireless networks.

Devroye will collaborate with engineers at companies such as Motorola, who will test her mathematical models to see if they work in real two-way scenarios, such as cell phone conversations or teleconferencing.

"I'll say, 'theoretically you should be able to transmit up to this many bits per second,'" she said. "Engineers will try to build coding schemes that achieve up to that limit."

Devroye is also working with graduate students at her Software-Defined Radio Lab and UIC's Wireless Communication Lab to develop models.

Provided by University of Illinois at Chicago