Rabia Tugce Yazicigil


(https://risingstars15-eecs.mit.edu/wp-content/uploads/Yazicigil.jpg)

Email: rty2102@columbia.edu (mailto:rty2102@columbia.edu)

Position: Ph.D. Candidate

Current Institution: Columbia University

Abstract:
Enabling 5/Next-G Wireless Communications with Energy-Efficient, Compressed Sampling Rapid Spectrum Sensors

Future 5G networks will drastically advance the way we interact with each other and machines and how machines interact with each other. The data storm driven by emerging technologies like “Internet of Things”, “Digital Health”, machine-to-machine communications, and video over wireless, leads to a pressing spectrum scarcity.

Future cognitive radio systems employing multi-tiered, shared-spectrum access are expected to deliver superior spectrum efficiency over existing scheduled-access systems. We focus on lower tiered 'smart' devices that evaluate the spectrum dynamically and opportunistically use the underutilized spectrum. These smart devices require spectrum sensing for interferer avoidance. The integrated interferer detectors need to be fast, wideband and energy efficient.

We are developing quadrature analog-to-information converters (QAIC), a novel compressed sampling (CS) technique for bandpass signals. With a QAIC the wideband spectrum can be sampled at a substantially lower rate set by the information bandwidth, rather than the much higher Nyquist rate set by the instantaneous bandwidth. As a result, innovative spectrum sensor RF ICs can be designed to simultaneously deliver a very short scan time, a very wide span and a high frequency resolution, while requiring only modest hardware and energy resources. This is not possible with existing spectrum scanning solutions. Our first QAIC RF IC demonstration scans a wideband 1GHz span with a 20MHz resolution bandwidth in 4.4μsecs, offering 50x faster scan time compared to traditional sweeping spectrum scanners and 6.3x compressed aggregate sampling rate compared to traditional concurrent Nyquist rate approaches. The unique QAIC bandpass architecture is 50x more energy efficient compared to traditional spectrum scanners and 10x more energy efficient compared to existing lowpass CS spectrum sensors.

Bio:
Rabia Tugce Yazicigil received the B.S. degree in electronics engineering from Sabanci University,

Istanbul, Turkey, in 2009, and the M.S. degree in electrical and electronics engineering from École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, in 2011. She is currently working towards the Ph.D. degree at Columbia University, New York. Her main research interests are in analog and radio frequency (RF) integrated circuit design, especially focused on integrated circuit techniques for spectrum sensing architectures to be used in cognitive radio applications. She has been a recipient of a number of awards, including the second place at the Bell Labs Future X Days Student Research Competition (2015), Analog Devices Inc. outstanding student designer award (2015) and 2014 Millman Teaching Assistant Award of Columbia University.