Department of Electrical and Computer Engineering
University of Maryland
June 5, 2020

Joseph JaJa

MERGING LEARNING AND INNOVATION TO SERVE THE NEEDS OF THE STATE, THE NATION, AND THE GLOBAL COMMUNITY

UNIVERSITY OF MARYLAND 1856

A. JAMES CLARK SCHOOL OF ENGINEERING

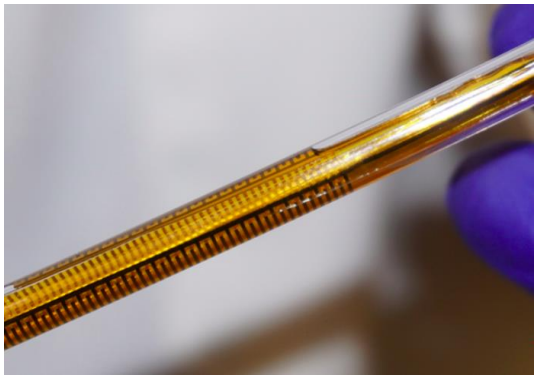
ECE under the Pandemic

- All activities and business operations continuing almost as usual:
  - Online Teaching went very well overall
  - Almost all the research activities continuing as before
  - More research funding and more proposals have been submitted
  - Business operation continuing almost as before
- New Enrollment Numbers for Fall 2020 are stronger than last year:
  - 152 ECE Freshmen compared to 110 ECE Freshmen confirmed last year at this time.
  - 53 Ph.D. students confirmed compared to 49 last year
- Improved business model after coming out of this!

Department Updates

- Rankings: EE and CE Graduate Programs ranked 14th nationally by latest US News&World Report
- Revised Computer Engineering Program, less required courses, more electives, and more senior courses
- New Ph.D. Qualifying Exam, enabling research earlier
- New Instructional Lab Initiatives (Juniper, Lin,…)

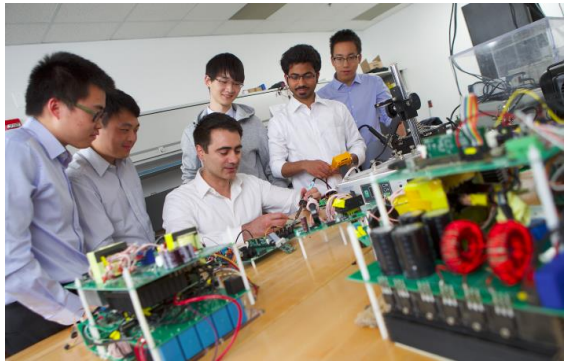
Communications and Networking



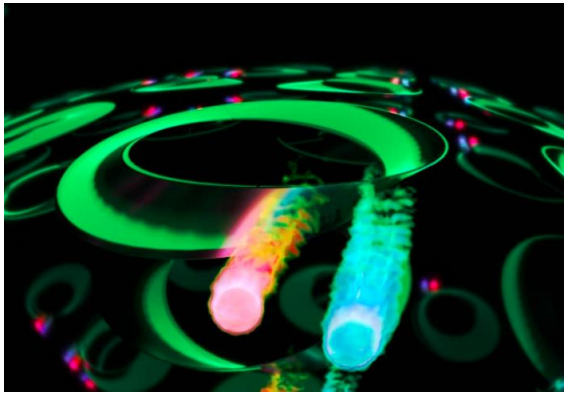
Bioelectronics and Systems

Cybersecurity and Cyberprivacy

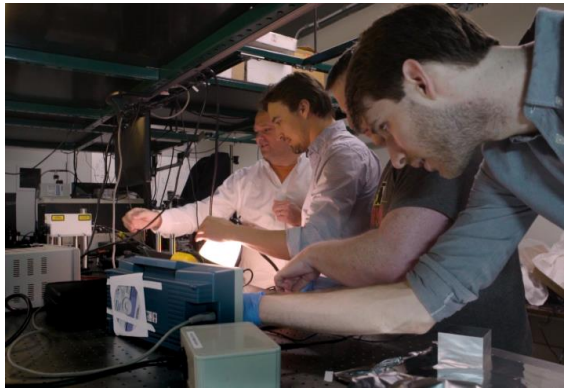
Control, Robotics, and Dynamical Systems



Devices, Circuits, and Electronic Materials



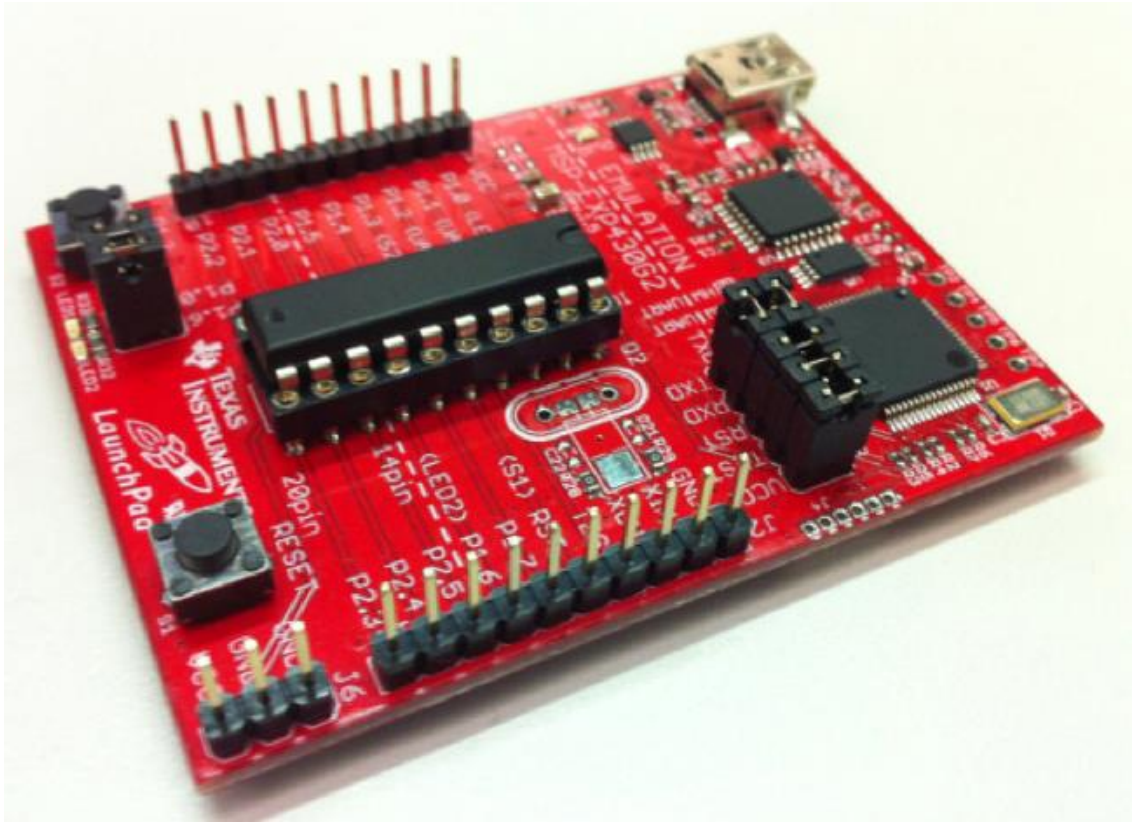
Quantum Technology



Electrophysics

Signal Processing and Machine Learning

- **Computer Engineering and Internet of Things**



Research News

Major new awards from NSF, NIH, DARPA, and DoD, with a total over **$25M**

Publications in most prestigious venues –

Science AAAS nature physicsworld

IEEE SPECTRUM

Faculty Recruiting

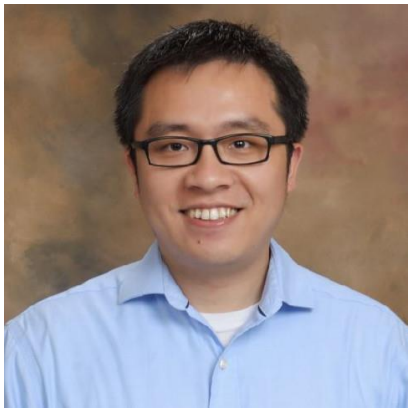
Before lockdown, a search was run to fill-in three positions: Quantum, Machine Learning, and Internet of Things.

Hiring Freeze imposed a week before the end of faculty candidate interviews!

Exception granted for IoT top candidate: Sahil Shah

New Faculty

Yanne Chembo



Cheng Gong

Percy Pierre

Ron Walsworth

Sahil Shah

Dr. Sahil Sah

- **Embedded machine learning and novel integrated circuits**
  - Reconfigurable and programmable mixed-signal systems
  - Novel hardware architectures.
  - Mixed-signal neural networks.

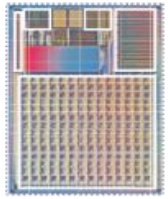
- **Bio-sensing and monitoring**
  - Physiological and vital signal monitoring.
  - Sensors on standard CMOS.

Example

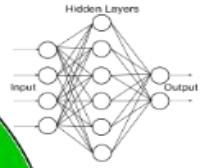
- **Bi-directional neural Interface**
- **Wearable devices for healthcare**

Memory, Bandwidth, Power etc.

eg:- Subthreshold mixed-signal circuits,
Fixed-point Digital accelerators,
Reprogrammable analog circuits



eg:- Fixed-point Neural Networks,
Bio-inspired Networks.



Energy-efficient integrated system

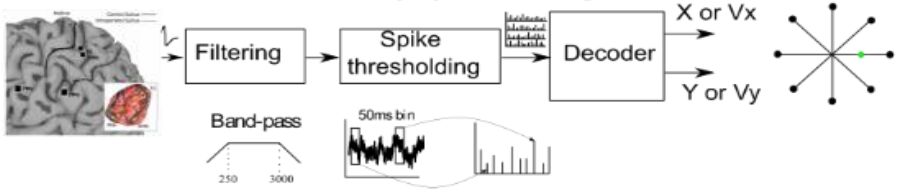
Embedded machine learning

Biological sensing and monitoring

SNR, dynamic range,
sampling frequency etc.

Feature
Engineering, Training data,
Targets etc.

eg:- Brain-Machine Interface,
ECG arrhythmia detection,
ACL injury monitoring



Quantum Technology Center

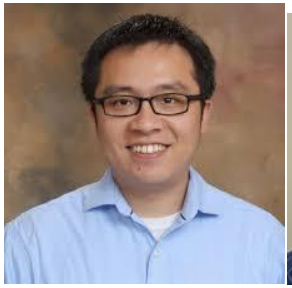
QTC mission

Chris Monroe

Steve Rolston

Edo Waks

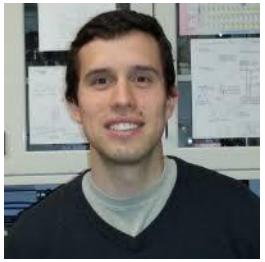
Ron Walsworth



Cheng Gong

Mohammad Hafezi

Alicia Kollar



Norbert Linke

The Quantum Technology Center (QTC)

Progress To Date

- **Roll out of the Inaugural Partner Program**
  - Solicitation of 20 companies ranging from multi-national corporations to startups
- **Involvement with the Department of Defense**
  - Furthering of the relationship with founding partner CCDC Army Research Lab
  - NGA
  - Office of the Under Secretary of Defense for Research and Engineering
  - Air Force
  - Naval Research Lab
- **Major Government Proposals**
  - NSF Convergence Accelerator submissions by Walsworth (sensing) and Waks/Linke (communications)
  - DoE- Quantum Information Science for Research for Fusion Energy
- **Invited Talks**
  - NGA (Virtual)
  - Booz Allen Hamilton Colloquium
- **Marketing**
  - QTC Twitter
  - LinkedIn
  - New Website

The Quantum Technology Center (QTC)

Upcoming

- **New Space**
  - The IDEA Factory- set to move in Spring 2021
  - Space in ARLIS's SCIF for classified projects
- **Startups**
  - Found first QTC startup in late 2020
- **Add Additional QTC Fellows**
- **Engagement with other Government Entities**
  - Department of State
  - Department of Homeland Security
  - National Institute of Health
  - NASA
- **Industry Sponsored Research Projects**
- **Topic Related Workshops**

Major Recent Faculty Awards

- Mohammand Hafezi: 2020 Mathematics and Physical Sciences **Simons Investigator Award**; Finalist for the 2020 **Blavatnik Awards for Young Scientists**
- Dinesh Manocha: **2020 Bezier Award** winner
- Alireza Khaligh: recipient of the 6th **Nagamori Award**
- Cheng Gong: **IUPAP Young Scientist Prize** in semiconductor physics (one of two)
- Tom Murphy: 2020-2021 **Distinguished Scholar Teacher** Award
- Several new **MURI Awards** (Antonsen, Chellappa, and Hafezi)
- John Baras elected **Fellow of the AIAA**

Major Recent Faculty Awards

- Rama Chellappa receives the 2020 **Jack S. Kilby Signal Processing Medal**
- Min Wu elected Fellow of the **NAI** and receives the **IEEE 2019 Harriett B. Rigas Award**
- Ray Liu elected Fellow of the **National Academy of Inventors (NAI)**
- Yanne Chembo elected **Fellow of the Optical Society**
- Behtash Babadi receives the **R. Robert Kent Teaching Award** for Junior Faculty
- Carol Espy-Wilson receives **Faculty-Student Research Award**

Major New Programs

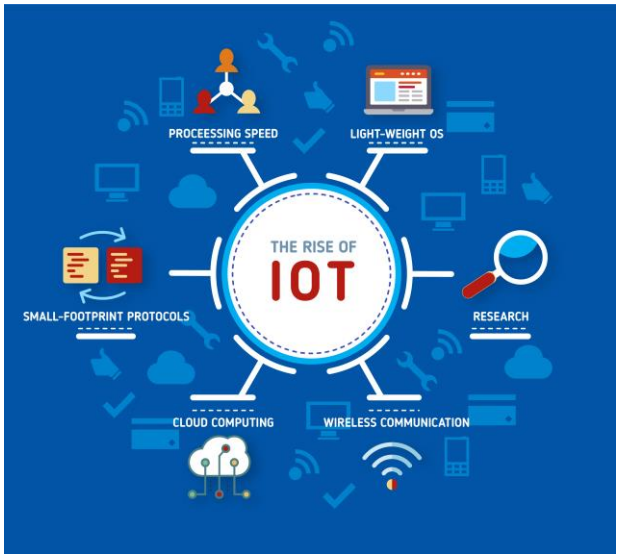
Establishment of the Quantum Technology Center, joint with Physics

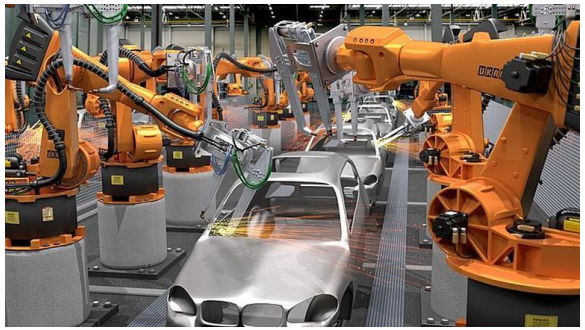
New B.S. in Embedded Systems and IoT at Shady Grove

Undergraduate Academy of Machine Learning, joint with CS

M.S. in Machine Learning, joint with CS

Internet of Things (IoT)





ES-IoT Academic Major

- B.S. degree in Embedded Systems & IoT will address the demand for IoT engineers
- The program will provide students with:
    - A solid foundation in key emerging technologies of IoT
    - The ability to integrate devices into complete IoT systems
    - Hands-on experience in building end-to-end systems
- Intended to be the first Embedded System program in the U.S. at a top-tier institution

Universities at Shady Grove

A. JAMES CLARK
SCHOOL OF ENGINEERING

MS in Machine Learning

- New professional MS program developed jointly by ECE and CS
  - Covers the core technical areas in machine learning
  - Provides practical, industry-oriented experience
  - Offers opportunities to work on a wide range of applications
- Degree requirements:
  - 30 credits total
    - 6 CORE COURSES
    - 4 ELECTIVE COURSES
    - SCHOLARLY PAPER

Academy of Machine Learning Started Fall 2019

Undergraduate concentration with transcript citation joint with Computer Science

Main Requirements:

- Probability and Statistics
- Algorithms, Data Structures, and Programming
- Fundamental Machine Learning Algorithms
- *Capstone Design Course with team projects suggested by industrial partners*

External Relations

Major Lab Initiatives:

- Juniper Network Lab- opening Fall 2019
  - Networking lab space for ENTS and Undergraduate Courses in Networking related topics
- Jimmy Lin Capstone Design Lab- opening Spring 2021
  - Lin Trust has given over $1.2M to ECE over the years
  - Newest lab will be a flexible lab for capstone design courses
- Lab donated by Paul and Ellen Gaske- to be worked on Summer 2021

Major Initiatives with Corporations (current and upcoming), including 26 Corporate Affiliates

Juniper Lab

- Major enhancement of course offerings:
  - Network Virtualization
  - Network Automation
  - Big Data Analytics
  - Networking Design and Configuration