



**University of Washington Computer Science & Engineering
Presentations and Laboratory Tours
STEM Education Innovation Alliance Meeting | September 20, 2017**

Overview of Computer Science at UW

Ed Lazowska | Bill & Melinda Gates Chair

[Presentation Slides](#)

Demand for computer science at the University of Washington (UW) and at other top bachelors and graduate institutions nationally is exploding. Demand is increasing for:

- ✓ Introductory courses - because every 21st century citizen requires fluency in “computational thinking”
- ✓ Upper-division courses by students majoring in other fields - because many fields require more than mere fluency in “computational thinking”
- ✓ Computer science majors - because computer science is great preparation for a vast range of fields and because the vast majority of all available STEM jobs in STEM are in computer science.

The workforce gap in our state – the gap between degrees granted and jobs available – is four times greater in computer science than in all fields of engineering combined!

The first 50 years of the field were all about “smaller/faster/cheaper.” The next 50 years will be all about tackling societal challenges. You’ll see some great examples in the following presentations – impacting education and medical screening/diagnosis.

There is an insatiable demand for graduates with a broad range of backgrounds and an important role for every educational institution to play. UW's educational role is graduating students who are top-tier software engineers, skilled at working in teams to design and build complex systems.

We are growing to meet needs in various ways: enrollment growth; a new mostly-privately-funded building to accommodate that growth; the creation of the Paul G. Allen School of Computer Science and Engineering; and our key role in the Global Innovation Exchange. Critical in the coming legislative session is obtaining \$3M in additional enrollment funding to complete a doubling of our degree capacity to more than 600 degrees per year – a process that was launched four years ago and stalled in the most recent legislative session.

Molecular Information Systems

Luis Ceze | Associate Professor

[Presentation](#)

Additional Information: <http://misl.cs.washington.edu>

The volume of data that needs to be stored is growing far faster than our ability to store it. UW's Molecular Information Systems Lab, in a joint project with Microsoft Research, is prototyping an approach to storing digital data in synthetic deoxyribonucleic acid (DNA) – nature's storage medium. Data stored in DNA is extremely compact – 10 million times as dense as the best silicon storage – and it's extremely durable (i.e., we can read dinosaur DNA).

The basic idea is to use DNA synthesis to write the data, and DNA sequencing to read the data. Some clever coding is required, however. The obvious approach of mapping 00, 01, 10, and 11 to A, C, G, and T doesn't work because repeated letters cause problems with the biology. Also, sophisticated error-correction codes need to be used. But this is the sort of thing that computer scientists know how to handle.

Read/write times are long – we expect to be able to do much better in the future than we can do today. Even so, DNA storage will be useful only for “cold storage” – archival data – and yet there is a huge amount of this. Amazon, for example, has a widely-used inexpensive archival store called *Amazon Glacier* that retrieves your data within 24 hours.

Computer science has propelled modern molecular biology forward. Through our work, molecular biology will propel computing forward.

Optimizing the Learning Ecosystem

Zoran Popovic | Professor

[Presentation](#)

Additional Information:

<http://centerforgamescience.org/>

<http://www.enlearn.org/>

UW's Center for Game Science (CGS) pioneers games for scientific discovery and games for learning.

Nearly a decade ago, the web-based game Foldit, co-developed with UW's Baker Lab in Biochemistry, revolutionized protein folding and protein structure calculation, by teaching non-experts to guide a sophisticated simulation program through a visual interface. As one example, a large group of people playing this game quickly solved an AIDS-related protein structure problem that had baffled the scientific community for 11 years. More recently, the web-based game Mozak, co-developed with the Allen Institute for Brain Science, has revolutionized neuron reconstruction, an essential component of neuroscience research.

CGS is now focusing intensively on games for learning. For example, CGS is developing adaptive, personalized, engaging games that help students master mathematics or English language arts dramatically better and faster by providing teachers with data that allows them to intervene in precisely the right way to guide learning.

It is important to emphasize that this is not a technology that gets the teacher out of the loop. Rather, it's a technology that makes the teacher vastly more effective. The research is carried out in CGS, and the deployment is carried out through Enlearn, a Seattle non-profit bootstrapped by the Gates Foundation. The effectiveness of the approach is amazing.

An exciting new initiative is to try to extend Enlearn's work to college readiness: diagnosing and remediating key high school concepts (initially in mathematics) enabling rapid progression. This work is funded by the Chan Zuckerberg Initiative.

The faculty and students at CGS are keenly interested in engaging with Washington school districts and colleges in this work – focusing on students at the high school / college boundary. Please inquire at www.enlearn.org or send email to sandi@enlearn.org.

Medical Screening/Diagnosis Applications

Alex Mariakakis | Doctoral Student

Additional Information:

<https://ubicomplab.cs.washington.edu/>

<https://www.youtube.com/watch?v=ZL0KQrzkE5g>

<https://www.youtube.com/watch?v=e62ZL3dCQWM>

The Ubiquitous Computing (UbiComp) Lab develops innovative sensing systems for real-world applications in health, sustainability, and novel interactions.

Belkin licensed and brought to market a system that you connect to your home's electric system at a single place and tells you exactly how much power every device in your home is using. This system uses machine learning to differentiate the various devices in your home by the "noise" they put on your power lines – lights, motors, power supplies, all put distinct noise patterns on the power line that can be "learned."

The startup company SNUPI Technologies, Inc. (later acquired by Sears Holdings) licensed and brought to market home sensors that detect motion, temperature, humidity, and moisture (water leaks) and that run for 15 years on a dime-size watch battery. The single most expensive homeowner insurance claim aggregated across the United States involves refrigerator ice makers leaking on the floor. Imagine having a sensor that you could toss under the fridge, and it would live there with the dust bunnies for more than a decade, alerting you to leaks!

Much of the presentation focused on health technologies, licensed to the startup Senosis Health Inc. We have figured out how to use the sensors on a smartphone to detect infant jaundice (bilirubin), to do spirometry, to detect the signature cough for tuberculosis, to measure blood pressure, to measure hemoglobin, to diagnose sleep apnea, and more. Many of these apps are undergoing the FDA approval process. Even in cases where these apps are not usable for diagnosis, they can be used for screening – avoiding the need for expensive and/or invasive definitive medical tests in cases where it's clear that there isn't a problem.

Laboratory Tours and Demonstrations

Molecular Information Systems Laboratory

Lee Organick

<https://www.cs.washington.edu/people/faculty/luisceze>

Robotics

Brian Hou and Rosario Scalise

<https://homes.cs.washington.edu/~sidh/>

Zero-Power Computing

Vikram Iyer and Mehrdad Hesar

<https://homes.cs.washington.edu/~gshyam/>