Welcome!

http://lazowska.cs.washington.edu/Overview.pdf, pptx
Today …

• Student demand
• Workforce demand
• What’s going on?
• The changing nature of the field
• The expanding role of the Allen School at the University of Washington
• Our role in the state
  – Education
  – Research
  – Entrepreneurship
• Growing to meet the need
  – Degree capacity
  – Space
  – The Paul G. Allen School
  – The Global Innovation Exchange
• The case for continued investment
Student demand: Top 10 first-choice majors of UW confirmed incoming freshmen

- Computer Science & Engineering
- Business Administration
- Biology
- Mechanical Engineering
- Psychology
- Bioengineering
- Nursing
- Mathematics
- Biochemistry
- Aeronautics & Astronautics

UW-Seattle offers 112 majors, and 87 specializations within various majors. These are just the top ten!
Computer Science is not just for computer scientists! It's a pillar of a 21st century liberal education!
Employer demand: Fields with Bachelors-level workforce gaps in Washington state, 2018-23

Washington Student Achievement Council / State Board for Community & Technical Colleges / Workforce Training & Education Coordinating Board, 2016

Our state’s workforce gap in Computer Science is 4X as great as the workforce gap in all other fields of Engineering combined!
### Employer demand: King County WA’s aerospace workforce

#### King County Aerospace Talent Pipeline

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1 Computer systems analysts</td>
<td>11,311</td>
<td>15,459</td>
<td>3.2%</td>
<td>Demand 22</td>
<td>135</td>
<td>Supply 22</td>
<td>(113)</td>
</tr>
<tr>
<td>2 Industrial engineers</td>
<td>3,175</td>
<td>3,289</td>
<td>0.4%</td>
<td>Demand 10</td>
<td>67</td>
<td>Supply 10</td>
<td>(57)</td>
</tr>
<tr>
<td>3 Aerospace engineers</td>
<td>2,942</td>
<td>2,899</td>
<td>-0.1%</td>
<td>Demand 38</td>
<td>126</td>
<td>Supply 38</td>
<td>25</td>
</tr>
<tr>
<td>4 Computer network architects</td>
<td>2,611</td>
<td>3,027</td>
<td>1.5%</td>
<td>Demand 37</td>
<td>62</td>
<td>Supply 37</td>
<td>25</td>
</tr>
<tr>
<td>5 Budget analysts</td>
<td>1,162</td>
<td>1,247</td>
<td>0.7%</td>
<td>Demand 34</td>
<td>57</td>
<td>Supply 34</td>
<td>20</td>
</tr>
<tr>
<td>6 Mechanical engineers</td>
<td>2,472</td>
<td>2,846</td>
<td>1.4%</td>
<td>Demand 15</td>
<td>30</td>
<td>Supply 15</td>
<td>15</td>
</tr>
<tr>
<td>7 Logisticians</td>
<td>2,730</td>
<td>2,673</td>
<td>-0.2%</td>
<td>Demand 14</td>
<td>14</td>
<td>Supply 14</td>
<td>10</td>
</tr>
<tr>
<td>8 Electrical engineers</td>
<td>2,521</td>
<td>2,963</td>
<td>1.6%</td>
<td>Demand 28</td>
<td>28</td>
<td>Supply 28</td>
<td>12</td>
</tr>
<tr>
<td>9 Operations research analysts</td>
<td>1,305</td>
<td>1,546</td>
<td>1.7%</td>
<td>Demand 25</td>
<td>25</td>
<td>Supply 25</td>
<td>14</td>
</tr>
<tr>
<td>10 Engineers, all other</td>
<td>2,039</td>
<td>2,356</td>
<td>1.5%</td>
<td>Demand 23</td>
<td>23</td>
<td>Supply 23</td>
<td></td>
</tr>
</tbody>
</table>

#### Q: At the Bachelors level ...

- What field has the **largest total number of current employees** in King County’s aerospace industry?
- What field has the **greatest predicted number of new employees needed** by King County’s aerospace industry from 2013-2023?
- What field has the **greatest predicted compound annual growth rate** for King County’s aerospace industry from 2013-2023?
- What field has the **greatest predicted annual gap between supply and demand** for King County’s aerospace industry from 2013-2023 (where “supply” is not “degrees granted” but rather the industry’s current ability to hire)?

#### A: Computer Science

Computer Science is not just for the software industry – our aerospace industry is dominated by computer specialists!

Nationally, just as in Washington, “it’s all about computer science”

Data from the spreadsheet at http://www.bls.gov/emp/ind-occ-matrix/occupation.xlsx
What’s going on?

• Every 21st century citizen requires fluency in “computational thinking”
  – This is driving introductory course enrollment

• Many fields require more than this – more than an introductory course sequence
  – This is driving demand for upper-division courses by students majoring in other fields

• Computer Science is great preparation for a vast range of fields – not just for work in the software industry
  – This is driving demand for the major, and also improving diversity

• Work in the software industry is no longer the Dilbert stereotype
  – Ditto
The changing nature of the field: From smaller/faster/cheaper to tackling societal challenges.

UW has led this modern view of the field – both in concept and in implementation.
The expanding role of the Allen School at the University of Washington

- The **Center for Sensorimotor Neural Engineering**, an NSF Engineering Research Center
- The **Center for Game Science**, funded by the Gates Foundation and DARPA to create revolutionary games for scientific discovery and for learning
- The **eScience Institute**, funded by the Moore, Sloan, Washington Research, and National Science Foundations to bring advances in data-intensive discovery to researchers campus-wide
- **dub** – “design-use-build” – a campus-wide collaboration that has made UW one of the top institutions in the world in human-computer interaction
- **Urban@UW**, a campus-wide urban science collaboration
• The **Taskar Center for Accessible Technology** develops and deploys technologies that increase independence and improve quality of life for individuals with motor and speech impairments

• **Change**, a campus-wide collaboration exploring how technology can improve the lives of underserved populations in low-income regions

• The **Tech Policy Lab**, a joint effort of the Allen School, the School of Law, and the Information School, funded by Microsoft

• **GIX** – the Global Innovation Exchange – a new kind of education that is global, project-based, and integrates technology, design, and entrepreneurship

Integral to major interdisciplinary initiatives in research and education
**Our role in the state: Education**

- There is an insatiable demand for graduates with a broad range of backgrounds – there is an important role for every educational institution to play
  - There is a wide variety of tech positions – from tech support to high-end software engineer, with much in between
  - The tech industry employs many people in non-tech positions
  - Non-tech companies employ many people in tech positions
  - Just about every field requires tech fluency

- What’s driving our economy, though, are the leading-edge tech companies of all ages and sizes
  - Our home-grown companies, from Microsoft and Amazon, to Zillow and Redfin, to the hot startups
  - The nearly 100 engineering offices of companies headquartered elsewhere, some of which have many thousands of employees (Google, Facebook)

- The people who power these companies – and who create the jobs for others – are highly capable software engineers

- UW CSE – the Paul G. Allen School – is *by far* the leading in-state producer of these people
Our role in the state: Research

• Ranked among the top half dozen of more than 200 research-oriented computer science programs
  • Stanford, Berkeley, MIT, Carnegie Mellon, UW, Cornell, Illinois, ...
• This pays off for undergraduates as well as graduate students
  • They are in the labs with us, pushing the state-of-the-art – that’s what makes them so highly prized
• Tight partnerships with many leading companies of all ages and sizes
• Note: Most of our graduate program alums do not head off to academic positions – they take positions at leading-edge tech companies in Washington
  • Microsoft and Google Seattle are by far the leading employers of our graduate program alums

A few examples ...
# Mobile, Virtual Reality, and Wearable Interaction

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EyeContact</td>
<td>In-head accuracy system and eye tracking for surgical reality</td>
</tr>
<tr>
<td>Finexus</td>
<td>Tracking accurate finger motions using magnetic sensing</td>
</tr>
<tr>
<td>MagnifiSense</td>
<td>Wearable magnetic sensor that monitors daily activity</td>
</tr>
<tr>
<td>SideSwipe</td>
<td>Detects in-air gestures using unmodified GSM signals</td>
</tr>
<tr>
<td>GripSense</td>
<td>Using thin sensors to detect hand posture and pressure on phones</td>
</tr>
</tbody>
</table>

# Health Technologies

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaperID</td>
<td>Paper interfaces based on long-range, passive RFID</td>
</tr>
<tr>
<td>SwitchBack</td>
<td>Tactile gating touching on mobile homes to gather attention for task absorption</td>
</tr>
<tr>
<td>Tongue-in-Cheek</td>
<td>Tactile signals for mobile non-invasive and flexible facial gesture detection</td>
</tr>
<tr>
<td>SurfaceLink</td>
<td>Intercepts multi-touch interactions on a surface</td>
</tr>
<tr>
<td>Static E-Field Sensing</td>
<td>Ultra-low power human body motion sensor using static E-field sensing</td>
</tr>
</tbody>
</table>

# Sustainability and Low-power Sensing

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpiroSmart</td>
<td>Monitoring from a remote phone</td>
</tr>
<tr>
<td>BiliCam</td>
<td>Using mobile phones to monitor respiration</td>
</tr>
<tr>
<td>DoppleSleep</td>
<td>Mobile CEIS-based sensor with concentration/physiological signal service</td>
</tr>
<tr>
<td>CoughSense</td>
<td>Automatic, auditory cough monitoring from a microphone</td>
</tr>
<tr>
<td>OsteoApp</td>
<td>Screening for osteoporosis on a smartphone using vibration</td>
</tr>
<tr>
<td>PupilScreen</td>
<td>Using smartphone to assess significant head traumas</td>
</tr>
</tbody>
</table>

# Miscellaneous

- **Shwetak Patel**
- **Paul G. Allen School of Computer Science & Engineering**
- **UBICOMP Lab, University of Washington**
- **Professor Shwetak N. Patel**
  - [http://ubicomp.lab.cs.washington.edu](http://ubicomp.lab.cs.washington.edu)
Small Update

We've posted a small update today; here's what's in it.

- Some stability fixes, particularly with crashes when canceling recipes.
- Improvements to scoring of sequence alignment. The scores of your existing alignments will change in the Sequence Alignment Tool due to this, but it won't affect your actual scores for the puzzles.

Enlearn

We close the achievement gap by making the entire classroom ecosystem adaptive to the learning needs of each student.
Data Storage on DNA Can Keep It Safe for Centuries

By AMY NAIRN
DEAL

SEATTLE — Computer data has been depicted as microscopic magnetic smudges, electric charges and even elliptical patterns of dots that reflect laser beams. It may ultimately move into the fabric of life itself — encoded in the organic molecules that are strung together like pearls to form strands of DNA.

Organic polymers DNA containing digital data for sequencing, which allowed them to retrieve the original files. (Fred Berger)
In partnership with ...

- Computer Vision, AR, and VR
- Machine Learning
- Natural Language Processing
- Robotics

All aspects of AI
Our role in the state: Entrepreneurship

• While education and research come first, entrepreneurship is alive and well
Growing to meet the need: Funded degrees per year
Growing to meet the need: A second building for UW’s world-class Computer Science & Engineering program

• Will provide the space to double CSE’s student capacity
• Vastly improved undergraduate facilities
• Vastly improved laboratory capabilities (e.g., a 3500 sf robotics lab)
• Architect: Seattle’s LMN Architects, architects for the Paul G. Allen Center
• General Contractor: M.A. Mortenson Company, general contractor for the Paul G. Allen Center
• Construction began in January 2017; completion slated for December 2018
• $74 million in private funds, including unprecedented levels of support from Microsoft, Amazon, Zillow, and Google – plus $17.5 million in state capital funds, $4 million in central UW funds
• An extraordinary campaign committee, led by Microsoft President Brad Smith
Growing to meet the need: The Paul G. Allen School of Computer Science & Engineering

- A $50 million endowment ($40 million from Mr. Allen, $10 million from Microsoft), to be funded over a number of years
  - Will provide critical **seed funding** to catalyze new initiatives in education and research, keeping UW CSE at the forefront, to the benefit of students, UW, and the region
    - Does not fund enrollment growth
    - Does not fund the new building
Growing to meet the need: The Global Innovation Exchange

• A global partnership, envisioned by Microsoft President Brad Smith
  – University of Washington, Tsinghua University, École Polytechnique Fédérale de Lausanne, Hong Kong University of Science and Technology, Indian Institute of Science, Korea Advanced Institute of Science & Technology, National Taiwan University, Technion - Israel Institute of Technology, Tecnológico de Monterrey, University of British Columbia
  – Microsoft, Arm, Baidu, Boeing, HorizonX, T-Mobile
• Project-based Masters degrees combining technology, design, and entrepreneurship in a global context
• GIX’s home – the Steve Ballmer Building – opened on September 14 in Bellevue’s Spring District
• Curriculum design and laboratory design led by Shwetak Patel (Paul G. Allen School + EE)
The case for continued investment

• One of the nation’s top programs, and a program with tremendous momentum
• Extraordinary student demand
• Extraordinary employer demand
• A leader in envisioning an outward-looking 21st century role for the field
• Impact all across the University of Washington – and the state, and the nation, and the world
• A leader in diversity and outreach – recipient of the first annual award from the National Center for Women & Information Technology
• An exemplary track record of fulfilling our commitments

The Gates Center will provide the space – we need to fill it with Washington students