

Computer science in the information age

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Admitted Student Decision Day

Eastern Connecticut State University

Department of Computer Science

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<http://gdancik.github.io/bioinformatics/ASDD/>

- The Computer Science degree program at Eastern Connecticut State University provides students the **foundations and skills for future work and careers in computing**.
- Upon graduation, students will:
 - Possess **practical and theoretical knowledge of computer science** sufficient to work professionally and contribute to the regional and global economic development.
 - Be able to **apply computational techniques to design and implement solutions to real-world problems**.
 - Be prepared **for advanced education in computer science and continued professional development**.
 - Possess the skills and the intellectual abilities that will enable them to **adapt in the ever-changing field of computer science**.

Occupational Outlook – Data from the Bureau of Labor Statistics

(<http://www.bls.gov/ooh/computer-and-information-technology/home.htm>)

| | OCCUPATION | JOB SUMMARY | ENTRY-LEVEL EDUCATION | 2012 MEDIAN PAY | Projected Growth (2022) |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------|--------------------------|
|  | <u>Computer and Information Research Scientists</u> | Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields. | Doctoral or professional degree | \$102,190 | Faster than average |
|  | <u>Computer Network Architects</u> | Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from a small connection between two offices to a multinational series of globally distributed communications systems. | Bachelor's degree | \$91,000 | Faster than average |
|  | <u>Computer Programmers</u> | Computer programmers write code to create software programs. They turn the program designs created by software developers and engineers into instructions that a computer can follow. | Bachelor's degree | \$74,280 | Average |
|  | <u>Computer Support Specialists</u> | Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems. | See How to Become One | \$48,900 | Faster than average |
|  | <u>Computer Systems Analysts</u> | Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both. | Bachelor's degree | \$79,680 | Much faster than average |

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|  | <u>Database Administrators</u> Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access. | Bachelor's degree | \$77,080 | Faster than average |
|  | <u>Information Security Analysts</u> Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increase. | Bachelor's degree | \$86,170 | Much faster than average |
|  | <u>Network and Computer Systems Administrators</u> Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks. | Bachelor's degree | \$72,560 | Average |
|  | <u>Software Developers</u> Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks. | Bachelor's degree | \$93,350 | Much faster than average |
|  | <u>Web Developers</u> Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as performance and capacity, which are measures of a website's speed and how much traffic the site can handle. They also may create content for the site. | Associate's degree | \$62,500 | Faster than average |



A Liberal Education. Practically Applied.

Visitors Future Students Current Students Alumni and Friends Faculty and Staff

- Computer Science major Requirements
 - <http://www.easternct.edu/computerscience/catalog/>



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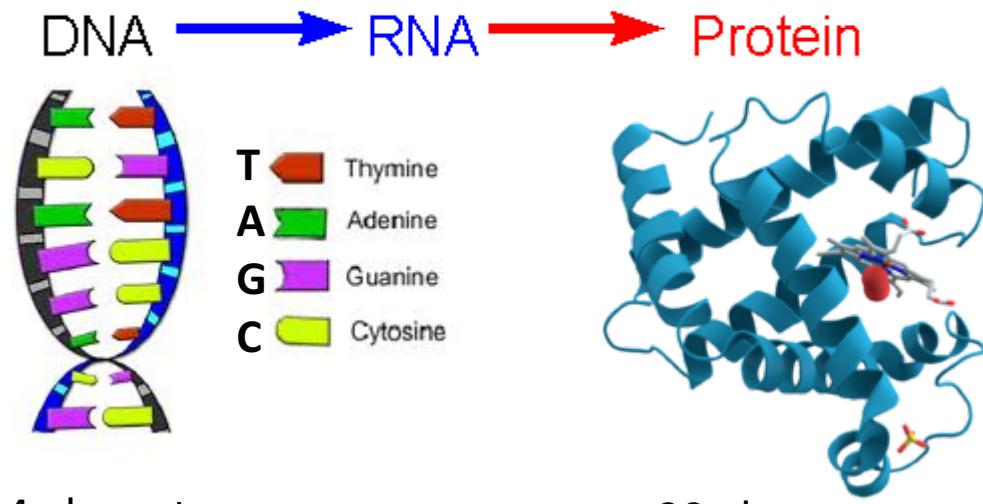
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■ Minors:

- Computer Science
- Computer Engineering
- Game Design
- Management Information Systems
- Bioinformatics

What is bioinformatics

- Bioinformatics:
 - Biology + information
 - the study and utilization of methods for storing, retrieving and analyzing biological data
 - Falls under the category of Big Data



4-character alphabet → 20-character alphabet

- How much information:
 - Human genome: 3 billion nucleotides
 - ~20,000 genes
 - many more when considering “junk DNA” and alternative splicing
 - >10 million sites of DNA variation
 - Countless possible interactions between DNA, RNA, and proteins

- NCBI sequence repository
<https://www.ncbi.nlm.nih.gov/>
- We will look at the gene HBB which codes for a subunit of hemoglobin (a molecule in red blood cells that carries oxygen)
 - DNA/Protein sequence
 - OMIM, dbSNP
- <http://www.ncbi.nlm.nih.gov/cancer>
 - We will look at a particular gene in cancer

What is Big Data?

- Datasets that are "large" or at least complex
- Generated by scientific studies, technology, and commerce
- From technology
 - <http://www.domo.com/learn/infographic-data-never-sleeps>
 - In one day, FB will receive 500 terabytes of data
 - 2.7 billion likes
 - 300 million photo uploads
 - From business
 - On Black Friday (2013), Walmart processed 10 million transactions in 4 hours

Big Data Examples

- What does FB know about you?
 - <http://www.nbcnews.com/science/gay-conservative-high-iq-your-facebook-likes-can-reveal-trait-1C8805606>
- What does Target know about you?
 - <http://www.nytimes.com/2012/02/19/magazine/shopping-habits.html>
- What information does your genome reveal about you?
 - Gender
 - Paternity and ancestry
 - Eye color
 - Relative Risk of breast cancer
 - Relative Risk of alcoholism

(Note that many genetic predictions are complex, not well understood, and can be difficult to interpret, genetic traits are often not black/white, and can be influenced by environmental factors)

The Follower Factory

A **scheduled bot** posts messages based on the time. The **Big Ben bot** tweets every hour.

SAMPLE CODE

```
when(time_of_day == 1)
  tweet("BONG")
```

Watcher bots monitor other Twitter accounts or websites and tweet when something changes. When the United States Geological Survey posts about earthquakes in the San Francisco Bay Area, the **SF QuakeBot** tweets the relevant information.

SAMPLE CODE

```
when(earthquake)
  tweet(quake_summary)
```

SAMPLE CODE

```
when(client_tweet)
  retweet(client_tweet)
```

https://twitter.com/big_ben_clock

<https://twitter.com/earthquakesSF>

<https://www.nytimes.com/interactive/2018/01/27/technology/social-media-bots.html>

What can we do with all of this information?

OPEN  ACCESS Freely available online



Influenza Forecasting with Google Flu Trends

Andrea Freyer Dugas^{1*}, Mehdi Jalalpour², Yulia Gel^{2,3}, Scott Levin^{1,2}, Fred Torcaso², Takeru Igusa², Richard E. Rothman¹

1 Department of Emergency Medicine, Johns Hopkins University, Baltimore, Maryland, United States of America, **2** Whiting School of Engineering, Johns Hopkins University, Baltimore, Maryland, United States of America, **3** University of Waterloo, Waterloo, Ontario, Canada

What can we do with all of this information?

APRIL 24, 2014

Update: Single Fire Hydrant Nets NYC \$33,000 a Year, not just \$25,000

Since there was [some interest](#) on my last [post](#) on the most lucrative hydrant in NYC, I wanted to download a bit more data and update the figures. My new download encompasses August 1, 2013 - March 26, 2014.

So with this fresh download, thanks to [NYC Open Data](#), we see that the second confusing hydrant on Forsyth place has moved into second place! I also made a Top 10 list of hydrants to avoid at all costs:

| Top Ticketed NYC Hydrants, August 1 2013 - March 26 2014 | | | | |
|----------------------------------------------------------|-----------|----------------|-------------------|-----------------------|
| Address | Borough | # Tickets | Total Fines (\$) | Annualized Fines (\$) |
| Opposite 152 Forsyth St | Manhattan | 187 | 21,505 | 33,118 |
| Opposite 104 Forsyth St | Manhattan | 139 | 15,985 | 24,617 |
| Front of 44 Court St | Brooklyn | 101 | 11,615 | 17,887 |
| Opposite 122 Montague St | Brooklyn | 95 | 10,925 | 16,825 |
| Front of 21 W 58th St | Manhattan | 91 | 10,465 | 16,116 |
| Opposite 100 Overlook Ter | Manhattan | 85 | 9,775 | 15,054 |
| Front of 720 Lenox Ave | Manhattan | 81 | 9,315 | 14,345 |
| Front of 2960 Fredrick Douglas Blv | Manhattan | 80 | 9,200 | 14,168 |
| Front of 2711 Valentine Ave | Bronx | 77 | 8,855 | 13,637 |
| Front of 1450 3rd Ave | Manhattan | 76 | 8,740 | 13,460 |
| Top 10 Total | | 1,012 | 116,380 | 179,225 |
| All Total | | 314,637 | 36,183,255 | 55,722,213 |

Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva^{1*}, Brett Kuprel^{1*}, Roberto A. Novoa^{2,3}, Justin Ko², Susan M. Swetter^{2,4}, Helen M. Blau⁵ & Sebastian Thrun⁶

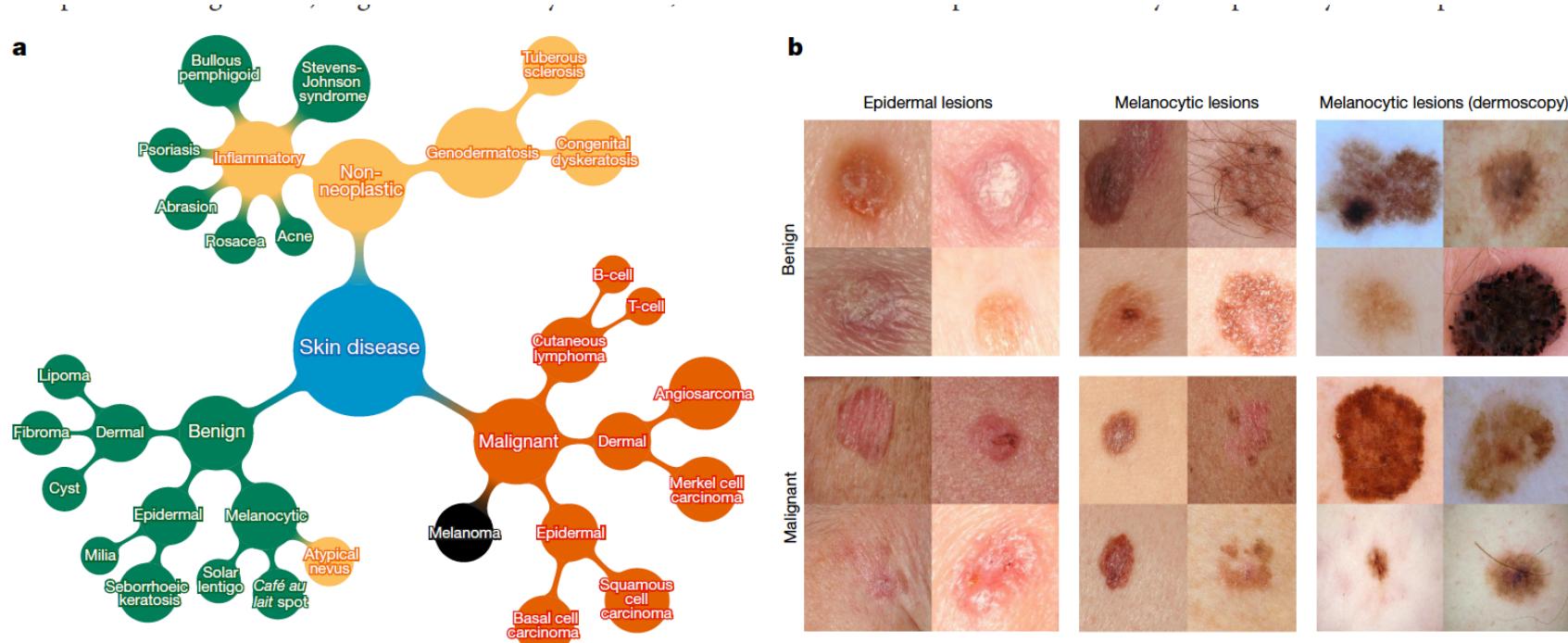


Figure 2 | A schematic illustration of the taxonomy and example test set images. a, A subset of the top of the tree-structured taxonomy of skin disease. The full taxonomy contains 2,032 diseases and is organized based on visual and clinical similarity of diseases. Red indicates malignant, green indicates benign, and orange indicates conditions that can be either

example images from two disease classes. These test images highlight the difficulty of malignant versus benign discernment for the three medically critical classification tasks we consider: epidermal lesions, melanocytic lesions and melanocytic lesions visualized with a dermoscope. Example images reprinted with permission from the Edinburgh Dermofit Library

JOE KEOHANE BUSINESS 02.16.17 07:00 AM

WHAT NEWS-WRITING BOTS MEAN FOR THE FUTURE OF JOURNALISM

future tense

THE CITIZEN'S GUIDE TO THE FUTURE

MARCH 17 2014 5:30 PM

The First News Report on the L.A. Earthquake Was Written by a Robot

By Will Oremus



Web scraping Example

- We will look at a simple web-scraping example using Python
- <http://gdancik.github.io/bioinformatics/ASDD/>

Thank You!

- Any questions?
- Contact:
 - dancikg@easternct.edu
 - <http://bioinformatics.easternct.edu>



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Computer Science Minor: Degree Requirements

This minor is designed for students who anticipate that computer science will have a prominent role to play in their academic and professional career. The minor emphasizes fundamental programming skills and hands-on experience applying those skills to computer-related projects.

I. Required Courses:

| | | | |
|-----|-----|-------------------------------------|---|
| CSC | 210 | Computer Science and Programming I | 3 |
| CSC | 231 | Computer Science and Programming II | 3 |
| CSC | 330 | Data Structures | 3 |

II. Select two additional CSC courses number 2XX or above (except CSC 200) or two additional courses in the discipline of computing that are approved by the Computer Science Program Chair.

Total Credits

Computer Engineering Sciences Minor: Degree Requirements

Objectives

This minor is designed to provide students with the mathematical background and practical experience expected of computer engineering majors. The objectives of the computer engineering sciences minor are the following:

1. To give students a background in engineering to assist them in graduate engineering schools.
2. To assist students in pursuing careers in engineering.
3. To afford science and mathematics students an experience in engineering.

I. Required Courses:

| | | | |
|-----|-----|-----------------------|---|
| CSC | 350 | Numerical Analysis | 3 |
| CSC | 351 | Signals and Systems | 4 |
| CSC | 355 | Digital Logic Lecture | 3 |

II. Select one Computer Science elective numbered 300 or above.

III. Complete the following Mathematics courses:

| | | | |
|-----|-----|------------------------|---|
| MAT | 310 | Applied Linear Algebra | 3 |
| MAT | 340 | Calculus III | 4 |

Total Credits

Game Design Minor: Degree Requirements

Objectives

The computer gaming minor addresses the needs of students interested in simulation, human machine interaction and gaming. This is an interdisciplinary minor covering both the artistic and computational needs of the field. Students with such a minor may work with animation, game engines, mathematics, modeling, network design, and state-of-the-art hardware and software.

I. Required courses:

| | | | |
|-----|-----|------------------------------------|---|
| ART | 343 | Introduction to 3D Animation | 3 |
| CSC | 311 | Computer & Video Games Development | 3 |

II. Select additional nine credits from the following list:

| | | | |
|---------|-----|----------------------------------------------|---|
| ART | 403 | 3D Imaging/Animation I | 3 |
| CSC | 312 | Computer Graphics | 3 |
| CSC | 337 | Computer Networks and Distributed Processing | 4 |
| CSC/MAT | 350 | Numerical Methods | 3 |
| MUS | 372 | Multimedia Composition | 3 |
| SOC | 320 | Video Games and Society | 3 |

Any 300/400 level course by arrangement with coordinator

Total Credits

15

Management Information Systems Minor: Degree Requirements

The goal of the Management Information Systems minor is to prepare students to contribute to an increase in productivity and the generation of new products, services and ventures, using state-of-the-art computer applications for better communication, problem diagnosis and decision making.

I. The MIS minor requires a total of 15*/18 credits as follows:

| | | | |
|-----|-----|-----------------------------------------------|---|
| CSC | 110 | Introduction to Computing and Problem Solving | 3 |
| | | | |

II. Two Business Courses:

| | | | |
|---------|-----|---------------------------------------------------|---|
| BUS/BIS | 442 | Information Technology Project Management | 3 |
| BIS | 361 | Business Information Systems and Web Technologies | 3 |

III. Any three of the following seven options:

| | | | |
|-----|-----|-----------------------------------------------|---|
| BIS | 370 | Systems Analysis and Design | 3 |
| CSC | 200 | Management Systems | 3 |
| CSC | 210 | Computer Science and Programming I | 3 |
| CSC | 231 | Computer Science and Programming II | 3 |
| CSC | 249 | Visual Basic or CSC 259 Advanced Visual Basic | 3 |
| CSC | 251 | Net-centric Computing | 3 |
| | | | |

Total Credits

15*/18

Bioinformatics Minor (pending): Degree Requirements

Bioinformatics is an interdisciplinary science that involves the development and use of computational, statistical, and mathematical tools to store and analyze large biological datasets such as genomic sequences. Bioinformatics is routinely used in genomics research and in personalized medicine to help decide on an appropriate treatment for a cancer patient. The minor will prepare students who want to pursue graduate studies in Bioinformatics or Computational Biology and will assist students in pursuing related careers.

I. Required Courses

| | | | |
|-----|---------|-----------------------------------------|-----|
| CSC | 210 | Computer Science and Programming I | 3 |
| MAT | 216 | Statistical Data Analysis OR | 3-4 |
| | 315 | Applied Probability and Statistics | |
| BIO | 230 | Genetics w/ Laboratory OR | 4 |
| | 304/314 | Genetics and Society Lecture/ Lab | |
| CSC | 314 | Introduction to Bioinformatics | 3 |
| CSC | 315 | Bioinformatics Programming and Analysis | 3 |

II. Select one of the following courses:

| | | | |
|---------|-----|-------------------------------------|---|
| CSC | 342 | Advanced Database Systems | 3 |
| CSC | 305 | Data Mining and Applications | 3 |
| CSC/MAT | 350 | Numerical Analysis | 3 |
| MAT | 373 | Explorations - Mathematical Biology | 3 |
| BIO | 450 | Biotechnology with Lab | 4 |
| BIO | 436 | Molecular Genetics with Lab | 4 |

Total Credits

19-21