Audrey Beard

Dept. of Computer Science
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY 12180

audreybeard.com

Education

Rensselaer Polytechnic Institute — August 2017 - August 2020
M.S. in Computer Science — GPA: 3.52

Seattle University — September 2014 - June 2017
B.S. in Electrical Engineering — GPA: 3.70
Specialization in Computer Engineering — *Magna Cum Laude*

City Colleges of Chicago — January 2013 - August 2014
General Education for Electrical Engineering — GPA: 3.51

College of DuPage — September 2010 - May 2012
General Education — GPA: 2.20

Naperville North High School — September 2006 - May 2010
High School Diploma

Teaching Experience

Computational Vision — August 2019 - December 2019
CSCI 4270 & 6270 — Rensselaer Polytechnic Institute
Computer Science Department

Theory, design, and implementation of computer vision algorithms, ranging from simple edge detection to homography estimation, to classification, segmentation, and clustering, to deep learning. This course was taught in Python, using the NumPy, OpenCV, and PyTorch libraries extensively, and required knowledge of algorithm design, basic probability and statistics, linear algebra, and multivariate calculus. I presented “Considerations of Computer Vision," which is discussed in the Lectures & Talks section.

Natural Language Processing January 2019 - May 2019
CSCI 4130 & 6130 Rensselaer Polytechnic Institute
Computer Science Department

Introduced students to parsing, part-of-speech tagging, sentiment analysis, symbolic and distributional semantics to long-short term memory units (LSTM's) and recurrent neural networks (RNN's) for NLP. This course was taught in Python.

Computational Vision August 2018 - December 2018
CSCI 4270 & 6270 Rensselaer Polytechnic Institute
Computer Science Department

Theory, design, and implementation of computer vision algorithms, ranging from simple edge detection to homography estimation, to classification, segmentation, and clustering, to deep learning. This course was taught in Python, using the NumPy, OpenCV, and PyTorch libraries extensively, and required knowledge of algorithm design, basic probability and statistics, linear algebra, and multivariate calculus.

Data Structures January 2018 - May 2018
CSCI 1200 Rensselaer Polytechnic Institute
Computer Science Department

Fundamental data structures, their use cases, and basic algorithms for their manipulation and organization. This course was taught in C++ and leaned heavily on the STL and was many students' first exposure to the language.

Computer Science I August 2017 - December 2017
CSCI 1100 Rensselaer Polytechnic Institute
Computer Science Department

Introduction to computer science, emphasizing abstraction, modular problem solving, and basic programming constructs, like loops, conditionals, file manipulation, I/O, and basic data structures. This course was taught in Python and was many students' first introduction to programming.

Research & Development Experience

Co-Researhcer January 2020 - May 2020
Rensselaer Polytechnic Institute Troy, NY
Computer Science Department
With Dr. James W. Malazita

I joined Dr. Malazita on the Critical CS1 project, an effort to bring critical feminist pedagogical practices into entry-level computer science practices. In my capacity as Co-Researcher, I assisted in the development of a hybridized CS/STS curriculum (including deep reading and summaries of assigned articles, and essay question and rubric development for said articles), prepared IRB proposals for data collection from human subjects, and helped several undergraduate students take on leadership roles in the research team.

Research Assistant January 2020 - May 2020
Rensselaer Polytechnic Institute Troy, NY
Computer Science Department
Supporting Dr. Charles V. Stewart

Creation of a public dataset and set of training and testing protocols to evaluate the performance of animal identification systems. This work is sponsored by RensselaerâĂŹs Cognitive and Immersive Systems Laboratory (CISL), and will help create a robust research community around computational conservation biology, specifically as it relates to photographic wildlife censusing.

Computer Vision Research Intern May 2019 - August 2019
The TRASH App, Inc. Brooklyn, NY

Proposed and developed a novel method for embedding actions in images and videos by decomposing actions into subject, verb, object triplets. My method emulates linguistic constructs, allowing us to directly compare visual features and semantically-significant word embeddings. Publication forthcoming.

Vision Research & Development Intern May 2018 - August 2018
Kitware, Inc. Clifton Park, NY

Researched, designed, and implemented a specialized object detector using Pytorch and other open-source machine-learning libraries. My research focused on implementing an adaptation of YOLO to improve performance on large-scale satellite imagery. This work formed the backbone of a system designed to correct imprecise human-annotated object detection.

Software Development Engineer Intern June 2017 - August 2017
98point6, Inc. Seattle, WA

I leveraged deep convolutional neural networks to classify medical images with state-of-the-art performance using tools like TensorFlow, Keras, NumPy, and Pandas on an AWS server. Working closely with a team of doctors, data scientists, and product managers, I determined and balanced the needs of each. Design considerations included diagnosis accuracy, theoretical foundation, user experience, and scalability. At the end of the summer, I communicated methods, results, and future work in a formal presentation to the entire company.

Research Assistant September 2016 - June 2017
Seattle University Seattle, WA
Electrical & Computer Engineering Department
Supporting Dr. Agnieszka Miguel

I researched and developed methods for motion analysis, segmentation, and image classification. Working closely with conservation biologists using images captured in static camera traps, we tackled the problem of identifying which images contained snow leopards and segmenting the leopards from background. We employed RPCA, the Viola-Jones algortihm, and an SVM to achieve a correct classification rate of **94%**. This work fed directly into a my senior project where I led a team of students to adapt existing software to to work with these segmented images for the purpose of clustering images into distinct animals of the same species. This research directly supports Panthera Corporation, which monitors and works to preserves big cat populations across the world. Our work is to appear in the Proceedings of the 2017 *IEEE Global Conference on Signal and Information Processing*.

Researcher May 2016 - August 2016
Florida Institute of Technology Melbourne, FL
AMALTHEA, a NSF REU Site

The *AMALTHEA* program (Advances of MAchine Learning in THEory and Applications) is a NSF REU site at the Florida Institute of Technology. Over the course of ten weeks, I worked to classify infrasonic events under the guidance of a graduate student mentor and Dr. Anthony O. Smith. We experimented with feature extraction methods to optimize classification of infrasonic signals, leading me to develop a novel technique for extracting invariable-length feature vectors from multiresolution, variable-length signals. This program taught me about the theory and implementation of classification algorithms such as support vector machines and artificial neural networks, as well as discrete signal processing methods such as cepstral analysis and the Hilbert-Huang Transform, forming a strong foundation for graduate studies. Our research was published in the Proceedings of the 2017 *International work-conference on Time-Series Analysis* and was selected to be published in the 2017 edition of Springer's *Contributions to Statistics*.

Research Assistant November 2015 - June 2016
Seattle University Seattle, WA
Electrical & Computer Engineering Department
Supporting Dr. Shiny Abraham

I designed and constructed sensor modules around a Raspberry Pi platform. Using C, Python, and Java, I programmed the computer to interact with sensors for data acquisition and act as a server for pushing data to cloud-based software for data logging and visualization. Our work consists of developing applications for Internet of Things (IoT) technologies in support of humanitarian relief efforts and environmental research, resulting in the production of a prototype device for measuring air quality that can be calibrated in the field for simple deployment by the layperson. Our work was accepted for presentation at the 30th annual *National Conference on Undergraduate Research.*

Electrical Design Engineer Intern June 2015 - August 2015
Kenworth Trucks Kirkland, WA

I assisted in transitioning from an outdated control system to an integrated electronic control unit architecture. My contributions involved researching various electromechanical systems and their functionality, designing the updated system to fit the new architecture, and writing test scripts for verifying the control capability of certain integral safety systems. My time at Kenworth taught me much about hardware and software development, industry best practices, and most importantly, the working environment of professional engineers.

Publications

(published under legal name)

- Agnieszka Miguel, **Joshua S. Beard**, Chleo Bales-Heisterkamp, and Rana Bayrakcismith. "Sorting Camera Trap Images." IEEE Global Conference on Signal and Information Processing 2017.
- Shiny Abraham, **Joshua S. Beard**, Renjith Manijacob. "Remote Environmental Monitoring using Internet of Things (IoT)." IEEE Global Humanitarian Technology Conference 2017.
- Shaelyn G. Divins, **Joshua S. Beard**, Nenad Mijatovic, Anthony O. Smith, Adrian M. Peter, Dean A. Clauter and Rana Haber. "Signal Classification using Covariance Matrices: A Riemannian Geometry Framework." International Work-Conference on Time-Series Analysis 2017

Lectures & Talks

- *The Politics of Vision: How computer vision shapes what we see and how we see it*
  February 2020
  Link
  This talk explains the basics of computer vision as a research and development practice and discusses its historical and contemporary politics (and political power), geared at undergraduate STEM students.

- *Considerations of Computer Vision*
  December 2019
  Link
  Speaking to upperclass undergraduates, MS, and PhD students with exposure to computer vision, I discussed algorithmic and data bias (with a focus on racism and sexism), historical politics of computer vision, and modes of discursive engagement to prepare and encourage students to be critical of this field.

- *Actions as Operators: Visual-Semantic Action Modeling*
  September 2019
  Link
  I discussed methods of action modeling, focusing on my novel visual-semantic embedding method developed at The TRASH App, Inc. In addition to discussing my research, I touched on general approaches and applications of action modeling and useful utilization of the triplet loss.

Project Portfolio

Tensorface November 2019 - Present
Designer and developer Software project
github.com/AudreyBeard/tensorface

Tensorface is a set of tools for interacting with Tensorboard log files. Since the log files are designed for reading by the Tensorboard server, they are somewhat clumsy to work with. This project uses custom Python classes to expose the data encoded within a log file as native Python data structures, like dictionaries and lists.

AWS_utils September 2019 - Present
Curator Software project
github.com/AudreyBeard/aws_utils

This project is designed to make it easy to do file copying between AWS buckets and local machines in parallel using Python's Multiprocessing library. Using this project, a developer can upload, download, and move huge amounts of files quickly and securely within Python - no command-line usage required (beyond *awscli* setup).

deep-learning-resources September 2019 - Present
Curator Software project
github.com/AudreyBeard/deep-learning-resources

This is a collection of blog posts, tutorials, software docs, and tweets collected from all over the web is aimed at deep learning practitioners. The purpose is to provide new researchers, developers, artists, and enthusiasts with information that they would not otherwise find in research papers. It is not a substitute to years of practice, but I hope that it helps jumpstart new users in the field. We use this in my lab at Rensselaer Polytechnic Institute for new student onboarding.

NetSounds May 2019 - Present
Designer and developer Software project
github.com/AudreyBeard/netsounds

NetSounds is a framework for sonifying convolutional neural networks. Based on the NumPy and PyTorch libraries for Python 3, this project uses customized convolutional neural networks and digital signal processing to transform what an AI system "sees" into an acoustic signal. The development required me to write custom classes for each unique network architecture, and relies heavily on broadcasting and vectorized programming on the GPU and CPU to minimize latency.

NetDev March 2019 - Present
Designer and developer Software project
github.com/AudreyBeard/netdev

NetDev is a deep neural network training framework that serves multiple purposes: eliminates excessive amounts of boilerplate code (like epoch looping, gradient updating, and data loader), and provides rich functionality (like logging, custom training/validation cycles, graphing, checkpointing, etc.). It is built around PyTorch, Tensorboard, tqdm, NumPy for Python 3. I use this extensively in my academic research for training neural networks and is being actively developed.

Youtill March 2019 - Present
Designer and developer Software project
github.com/AudreyBeard/youtill

Youtill (a play on util), is a small collection of custom functionality for Python code that I have written enough times to warrant its own deployment. It is mostly designed as a time-saving measure, and so it includes things like numeric string checking (with support for floats), parameter verification (including type, value, and range restrictions), iterable checking, matrix shape suggestion, and custom function deprecation warnings.

PlottingTools January 2019 - Present
Designer and developer Software project
github.com/AudreyBeard/plottingtools

PlottingTools is a wrapper for MatPlotLib for Python 3, and is designed to make common graphs easy to plot with as few lines as possible. It grew out of my desire to explore data quickly without relying on heavier data structures like Pandas DataFrames, and without reduplicating code. It is available on the Python Package Index as `pip install plottingtools` and enjoys intermittent updates.

vimwiki_link_network January 2019 - June 2019
Designer and developer Software project
github.com/AudreyBeard/vimwiki_link_network

This project, designed as a tool to assist my knowledge gathering for research, leverages the vimwiki project's index-building structure to build structured knowledge graphs using NetworkX. My software reads a full vimwiki article system (starting at the index), and displays each page as a separate node in a graph, with links to other nodes as directed edges. I had not been aware of Project Xanadu at the time of development, but having learned about it since, the similarity to it is notable.

Awards & Achievements

Elected Vice President of Graduate Council at Rensselaer Polytechnic Institute
2019-2020

Elected Graduate Senator at Rensselaer Polytechnic Institute
2018-2020

Elected President of Alpha Sigma Nu Jesuit honor society
2016-2017

Inducted to IEEE Eta Kappa Nu honor society (Mu Iota Chapter)
2016

Awarded a NSF REU at Florida Institute of Technology
2016

Inducted to Alpha Sigma Nu honor society (Seattle University Chapter)
2016

Presented at 2016 National Conference on Undergraduate Research (NCUR)
2016

Awarded travel grant for NCUR by Seattle University Office of Research Services and Sponsored Projects
2016

Co-President of Seattle University Cycling Club
2015-2017

Inducted to Tau Beta Pi honor society (Washington Gamma Chapter)
2015

Dean's List, College of Science and Engineering, Seattle University
2014-2016 (except Fall Quarter 2015)

Elected Vice President of Scholarship, Phi Theta Kappa (Nu Lambda Chapter)
2014

Inducted to Phi Theta Kappa honor society (Nu Lambda Chapter)
2014

Dean's List, City Colleges of Chicago
2013-2014

Volunteer Experience

Organizer & Discussion Moderator — November 2019 - Present
Rensselaer for Ethics in Science, Engineering, and Technology (RESET) — Troy, NY

RESET is a student organization that holds discussion groups, a lecture series, and organizes political action at Rensselaer. Some of our focuses include capital and technology, technized racism and sexism, military-industrial-academic efforts, and “ethics" in science practice and technological development and deployment.

Senator & Vice President March 2018 - March 2020
Graduate Council, Rensselaer Polytechnic Institute Troy, NY

The Graduate Council fills several roles in serving graduate student interests on campus, including: conducting periodic surveys of graduate student/worker life, organizing social events, serving as students' first point of contact for graduate-specific issues, and advocating to the Institution's administration for graduate student concerns. In my capacity as Graduate Senator, I actively fight for racial and ethnic minority issues, LGBTQ+ issues, accessibility on campus, decreased fees for graduates, sustainability, and greater accountability for Title IX cases. Specific focuses have included: facial recognition ban on campus, universal shuttle access for all buildings on campus, increase in graduate worker stipends, establishment of an Underrepresented Minority Students Committee, and greater accountability and reporting for abusive student/advisor relationships.

President September 2016 - June 2017
Alpha Sigma Nu (ASN), Seattle University Chapter Seattle, WA

This international service-based honor society for Jesuit institutions accepts only 4% of each class each year. As Chapter President, I supervised and coordinated all club activities and programs. Among these events were our inaugural *Standing with Refugees*, a dinner to celebrate and learn about refugees in America, and our annual Acceptance Ceremony, a formal induction to ASN for new members.

Shop Committee Lead and Mechanic-Educator August 2015 - August 2017
The Bikery Seattle, WA

The Bikery is a nonprofit bicycle shop which serves the community by teaching people how to fix their own bicycles. This organization accomplishes this by providing tools, a space to work, and the bicycle repair knowledge and experience of volunteers. In my first year as a Mechanic-Educator, I helped with the complete reorganization of The Bikery by establishing and ultimately leading the Shop Committee. In less than one year, we raised thousands of dollars and improved in-shop efficiency to offer more services to more patrons, allowing us to double our open hours and serve hundreds of people monthly. As the Shop Committee Lead, I had a hand in all

day-to-day in-shop operations, including revenue management, training, inventory management, bicycle refurbishment, workspace design and maintenance, and interpersonal conflict resolution. I was also afforded the opportunity to continue my work as a Mechanic-Educator every weekend, teaching people how to work on their own bicycles, an activity I came to love.

Skills

Computing Languages: Python, BASH scripting, C/C++, MATLAB, LaTeX, SQL, VHDL

Computing Frameworks: PyTorch, NumPy, OpenCV, Keras, Pandas, TensorFlow

Coursework: Computational Vision, Machine Learning, Algorithm Analysis Design, Digital Signal Processing, Signals Systems, Computer Operating Systems, Data Structures

OS Proficiency: Linux *Debian* and its derivatives, OSX, Windows

Miscellaneous: MS Office & other productivity software, Public Speaking, Research Agenda Design, Teamwork, Technical Writing

Research Methods: Scientific method for quantitative data, qualitative coding, ethnographic research

June 20, 2020