Colin K. Curtis - Software for Computer Vision

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Major Achievements

- **Developer** - Adaptive Learning Analysis for Images (ALAI), a Computer Vision application
- **Developer** - 'icees-client' a pip-installable Python module for interfacing with clinical-data-housing ICEES API
- **Developer** - Bicluster Co-Occurence Algorithm for the RNAseqDB biclusters computed using the MAK algorithm
- **Author** - Multiple academic publications in the Physics sub-fields of Tribology, Optics, and Polymer Science
- **Project Manager and Author** - 'Friction: Friend and Foe', book chapter in Surface and Interface Science Vol. 8
- **Organizer** - Carrboro High School AP Science Class tours of NCSU Physics ORaCEL labs and equipment
- **National Meritorious Winner (Team of 3)** - COMAPS MCM, 2011 - Radio Repeater for Network Optimization

Work Experience

Senior Software Engineer - EASi; *April 2019 - Present*

- Tire Footprint Visualization and Analysis
- Deep-learning for facial analysis in automotive settings
- Computational geometry techniques including alpha shape generation
- Measurement and presentation of physical parameters for engineering and design
- Machine-learning techniques for automatic analysis of many distinct tires

Research Software Engineer - Renaissance Computing Institute (RENCI); *June 2018 - March 2019*

- NIH National Center for Advancing Translational Sciences (NCATS) - Biomedical Data Translator Project - Green Team
- Statistical Analysis: risk/odds ratio testing and Bayseian statistics to quantify drug performance
- Utilized Jupyter Notebooks, with Python3, to analyze data and visualize results in an interactive, shareable format
- Embedded SQL and SPARQL queries within Python to access and parse Ontologies
- Accelerated data collection from APIs through use of concurrent I/O using 'asyncio' and 'concurrent' modules
- Performance tested services for high-concurrency request loads using and 'locustio' and 'pytest'
- Worked remotely with a Computational Biologist, through Slack, to develop an algorithm for aggregating gene and tissue IDs and then finding ID co-occurrence patterns in that data (publication in planning stage)

Research Assistant, Krim Group; *January 2015 - December 2018*

- Developed ALAI, a MATLAB computer vision application, for automating image analysis (Independent Coding Projects)
- Primary skills: equipment building, data capture, data analysis, and mathematical modeling
- Subject-matter expertise: in carbon nano-structures, inter-facial friction
- Participated in two National Science Foundation (NSF) funded projects: DMREF and QCM
- Software packages and programming environments included Origin, LabVIEW, MATLAB, and Python 3
- See Research Publications

Research Assistant, Clarke Group; *January 2013 - July 2014*

- Research focus: Polymers, LASER for spectroscopy and photothermal heating, nanoparticle synthesis
- Utilized ANSYS Maxwell mesh-calculation to simulate 3-D electro-magnetic fields
- Used and maintained LabVIEW software systems for instrument control and data collection
- See Research Publications

Teaching Assistant, Department of Physics, NC State University; *August 2012 - December 2014*

- Instructor for introductory physics laboratory sections (PY 205 and PY 208)
- Provided theoretical introduction to the relevant course materials
- Organized and maintained teaching-laboratory equipment

Professional Skills & Interests

Languages & Environments

- Python 3
- MATLAB, LaTeX
- Linux, macOS, & Windows

Software Engineering Toolkit

- Software & Algorithm Design
- Object Oriented Programming
- Time and Space Complexity Analysis
- Graph Databases
- Docker, Github, & Jenkins
- Jupyter Notebook
- RESTful & OpenAPI standards
- SaaS
- VMs & Virtual Envs
- asyncio (concurrent network I/O)
- json & yml
- SQL & SPARQL
- opencv-python & tensorflow
- pytest & locustio
- networkx, obonet, & pronto
- mezos, marathon, & nginx
- Flask, swagger, & gunicorn
- Jinja2 & cwltool
- requests & certifi
- pandas & numpy
- memory_profiler
- zlib

Professional Skills & Abilities

- Statistical Data Analysis
- Image Analysis
- Effective Programming Skills
- Strong Written, Verbal, and Quantitative Skills
- Advanced Physics & Mathematics
- Adaptable to Diverse, Multi-disciplinary Teams
- Data Analysis and Engineering
- Fractal Analysis
- Systems Development and Engineering
- First Principles based Analytical Thinking
- Agile & SCRUM Development Experience
- User Interface Design & Documentation

Other Interests

- Conversational Hindi & Spanish
- Frankenstein, Consciousness, & AI
- Sci-Fi, History, and Biographies
- Running and Mixed Martial Arts
- Parallel Programming
- Gardening and Cooking

Independent Coding Projects

code repository at www.github.com/colinkcurtis

Adaptive Learning Analysis for Images (ALAI), A Computer Vision Application

- A Computer Vision application utilizing custom iterative categorization and regression fitting techniques
- Written using MATLAB, an ideal tool for linear algebra and statistics over large matrices
- ALAI calculates and produces figures for: fractal dimension, saturation roughness, and correlation length
- Reduced user's active analysis time, per image, by a factor of ~50, drastically reducing labor costs
- Classification of 'fitting zones' (linear v. exponential) by $Adjusted - R^2$ comparison between multiple fitting attempts
- Weighting and bias-of-fit calculated according to uncertainties from measurements stored in file meta-data

HackerRank Challenges

- Project Euler 220: Heighwey Dragon
- Project Euler 217: Balanced Numbers
- Project Euler 206: Concealed Square
- Project Euler 1: Multiples of 3 and 5

Education Milestones

- **M.S. Physics**, North Carolina State University (2014)
- **B.S. Physics, Mathematics Minor**, Appalachian State University (2012)

Research Publications

- First Author, *A Comparative Study of the Nanoscale and Macroscale Attributes... of Nanodiamonds*, Beilstein Journal of Nanotechnology, Sep 2017 (PDF available here: https://www.beilstein-journals.org/bjnano/content/pdf/2190-4286-8-205.pdf)
- First Author, *Diffusion of Gaseous Ethanol and Water through Functionalized Graphene and Graphene Oxide Membranes*, Manuscript in Preparation
- First Author, *Aqueous Inter-facial Friction on Smooth and Rough Au Surfaces Mediated by Functionalized Nanodiamonds*, Manuscript in Preparation
- Second Author, *Unconfined, melt edge electrospinning from multiple, spontaneous, self-organized polymer jets*, Materials Research Express, 28 Nov 2014 (Vol. 1, Num. 4)
- Third Author, *A Tribological Study of γ-Fe$_2O_3$ Nanoparticles in Aqueous Suspension*, Tribology Letters, Dec 2018 (66:130)