Colin K. Curtis - Software Engineer

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Major Achievements

- **Author** - Multiple academic publications in the Physics sub-fields of Tribology, Optics, and Polymer Science
- **Developer** - Adaptive Learning Analysis for Images (ALAI)
- **Developer** - Gibber Trading Tracker (GTT)
- **Project Manager and Author** - 'Friction: Friend and Foe', book chapter in Surface and Interface Science Vol. 8
- **National Meritorious Winner (Team of 3)** - COMAPS MCM, 2011 - Radio Repeater Network Optimization

Work Experience

Research Assistant, Krim Group; January 2015 - Present

- Research focus: data analysis, predictive modeling, functionalized carbon nano-structures, friction, surface effects
- Paid Research Assistant for two major National Science Foundation funded projects: DMREF and QCM
- Utilized software packages and programming environments including LabVIEW, MATLAB, and Python 3
- Central responsibility was collection, analysis, interpretation, and presentation of data
- Optimization and organization of the lab group's time and equipment
- See Research Publications

Research Assistant, Clarke Group; Jan 2013 - July 2014

- Research focus: Polymers, LASER for spectroscopy and photothermal, nanoparticle characterization and synthesis
- Designed and built a melt electro-spinning device for polymers, producing ultra-fine fibers without solvent
- Utilized ANSYS Maxwell mesh-calculation to simulate 3-D electro-magnetic fields
- Used and maintained LabVIEW software systems for instrument control and data collection
- Second Author, *Unconfined, melt edge electrospinning... polymer jets*

Teaching Assistant, Department of Physics, NC State University; August 2012 - May 2014, August 2014 - Dec 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
- Provided real-time feedback and assistance to students via the Socratic method

Code in Development

code repository at www.github.com/colinkcurtis

Adaptive Learning Analysis for Images (ALAI), A Machine Learning Application

- This automation reduced costs of image analysis, for a single publication, from $2500 dollars (50 hours at $50 per hour) to 25 dollars (30 minutes at $50 per hour)!
- Adaptive Learning algorithm, which optimizes the fitting, is a generalized algorithm
- Fitting of data using iterative categorization and regression
- Weighting and bias of fit automatically calculated according to uncertainty in measurement
- Classification of continuous fitting zones (linear v. exponential) by $Adjusted - R^2$ goodness of fit comparison
- In the context of my doctoral research, used to find: fractal dimension, saturation roughness, and correlation analysis from Atomic Force Microscope images
- Written in MATLAB, chosen as the correct tool for processing large matrices

Gibber Trading Tracker (GTT)

- Retrieve, filter, and record data for: market listings, account balances, and transaction records
- Retrieve data from remote financial databases via RESTful style (Bittrex API 2.0 in code sample)
- Filter data using Regular Expression methods used to filter and sort to ensure data integrity and usability
- Record data in a format of the user's choosing, including SQL, CSV, or JSON formats
- Proprietary financial predictive modeling and data analysis built in and presented via GUI
- Written in Python 3 to allow for user customization and flexibility
- Python provides access to numerous ready-made and custom data analysis tools, which any user can build onto GTT

Professional Skills & Interests

Data Science & Machine Learning Toolkit

SciPy	Pandas	DataFrames	Custom algorithms

Languages & Environments

Python 3	MATLAB	Debian and Arch Linux	VMs and Virtual Envs

Coding Skills & Abilities

Data engineering	Predictive modeling	Agile methodology	LaTeX type-setting

Other Skills & Interests

Technical writing	Statistical Mechanics	Conversational Spanish	HackerRank challenges

Education Milestones

- **Ph.D. Physics**, North Carolina State University, Nanotribology (2018)
- **M.S. Physics**, North Carolina State University, Fluorescence Spectroscopy (2014)
- **B.S. Physics, Mathematics Minor**, Appalachian State University, Raman Spectroscopy (2012)

Research Publications

National Science Foundation (NSF) DMREF - Designing Materials to Revolutionize and Engineer our Future

- 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, *Superparamagnetic Nanoparticle Mediated Dissipation in the Presence of External Magnetic Fields*, Manuscript in Preparation
- Four-department collaboration, bringing together Physics, Statistics, Material Science, and Chemistry to analyze experimental materials and data.
- Using multi-dimensional statistical analysis, prediction of likely-to-be-effective lubricants drives the experimental design. Validation or refutation of that proposed next material was conducted and the cycle perpetuated.
- Several novel lubrication combinations were discovered, including in my work with aqueous nanodiamonds

NSF Quartz Crystal Microbalance Studies of Graphene and Graphene Oxide Membranes

- First Author, *Diffusion of Water and Ethanol through Hydrogenated Graphene and Graphene Oxide Membranes*, Manuscript in Preparation
- Experiments involving gaseous diffusion through functionalized graphene and graphene oxide layers, in vacuum, to study the permeability of, and friction experienced by, nanoscale carbon membranes in the presence of common gases

Personal Interests

- Sci-Fi, History, and Biographies
- Running and Brazilian Jiu-jitsu
- Gardening and Cooking