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Statement of Purpose

I am a mathematician-turned-data engineer with a penchant for applying rigorous quantitative thinking to difficult problems in the technology space. I am notorious for asking the right questions. I have a deep love for information presentation and communication.

Education

- Jun-Jul 2016: Stamen Design Building Interactive Maps with D3 Workshop
- Oct 2015-Jan 2016: Galvanize Data Engineering Immersive
- May 2015: Galvanize D3 Workshop
- Sept 2008-May 2014: Ph.D. in Mathematics, Kansas State University
  - *University Academic Excellence Award.*
  - *Surowski Memorial Fellowship Research Excellence Award.*
- Sept 2004-May 2008: Bachelors Degree in Mathematics, Westminster College.

Professional Experience

Data Engineering

Galvanize Data Engineering Immersive October 2015-January 2016

- Project driven course covering several of the most popular and essential big data technologies, architectures, and algoritms. Solo and pair programming labs daily–implementing, problem solving, and testing.
- **Data Engineering Capstone**: Spark Streaming log file parser.
- **Used Spark, Scala, Kafka, MapReduce, Hive, Pig, Sqoop, Flume, Scalding, HDFS, Hadoop, Python, REST API, JSON, Java, JUnit, and more**

IBM(Aspera Labs) February 2014-Present: Software Engineer, Research and Development

- Designed a Spark Streaming Data Pipeline *(Ongoing)*
  - Designed, implmented, and integrated a novel downsampling algorithm for high-volume disjoint non-uniform time-series data. *Paper forthcoming*
  - Utilizing Spark, Spark Streaming, ScaleKV(Redis), and ASCP I designed an injest pipeline for processing high value log files in real time, and serving a front end D3 visualization platform.
  - Designed and implemented a Lambda architecture integrating Kafka, Spark Streaming, Redis, and Elastic Search for ETL, processing, short-term and long-term data storage.

Data Science and Software Engineering

Quasicoherent Labs January 2016-Present: Founder, Data Scientist

- *SpeaksLike*: Stump speech text comparison and analysis
  - Built a webscraper to collect public data on presidential candidate stump speeches; cleaned and preproccessed the data for NLP.
  - Implemented K-means clustering, PCR, and Gap statistic calculations for text corpuses.
  - Wrote and implemented a novel cluster metric for cluster comparison.
  - Wrote and implemented a novel distribution(and corresponding kernel method) for text corpuses, integrated with K-means.
  - Wrote and implemented a sentiment based, and intensity based weight vector for text clustering.
  - Used the above methods to compare similarity(and similarity significance) of 2015 stump speeches. *Paper forthcoming*

IBM(Aspera Labs) February 2014-Present: Software Engineer, Research and Development

- Data Visualization Dashboard and Log File Processing
  - Built D3 data visualizations for extremely high dimensional data sets parsed from transfer log files.
  - Brainstormed, prototyped, tested, implemented and redesigned more than 20 different data visualizations for a custom data dashboards for incredibly large and high resolution data.
  - Met with expected customers of dashboard, and implemented their requests and suggestions for the dashboard.
  - Integrated visualizations into a large Ruby and JS codebase, pulling data from a Python/Hadoop backend live datastore.
  - Presented dashboard and analysis results at IBC in the Netherlands to hundreds of customers; answered technical questions and usage questions from engineers, managers, and sales-people.
  - Worked in a team of 3.
- Livestream data transfer experimentation, analysis, and paper writing
  - Designed an experiment to test efficiency of a new livestream video technology quatitatively.
  - Utilized a modification of TCPDump to observe packets in large scale transfers and gather *perfect* resolution data at the packet level.
  - Designed and ran a large test rubrik and data pipeline in BASH and Python to manage the transfers, collect the data, parse the data, analyze the data, and output the data to a D3 visualization.
  - Wrote a white-paper; presented paper and analysis at NAB in Las Vegas to thousands of customers; shortlisted for the Game-Changer award for analysis proving the efficiency of the new technology and its applicability to the use-cases; answered technical questions and usage questions from people all across the media-tech space, including a panel of judges.
- Brainstormed and prototyped a number of data products for integration with Aspera's core software. This ranges from researching ML algorithms in specialized fields, to extensive mathematical modeling of signals.
- Satellite network analysis
  - Designed an experiment to test network qualities of a particular satellite network.
  - Configured the network, built the test framework, built the data pipeline for processing, generated data visualization and analysis. Used data analysis to redesign the transfer for networks of this type.
  - Expanded test cases to include WAN networks. Retested, and expanded model to include WAN use-cases.
  - Brainstormed and prototyped modifications to the core technology for optimization of these networks.
  - Worked with an intern.
- **Used Python, REST API, JSON, Javascript, D3.js, CSS, HTML, Awk, Sed, BASH, GNUplot, C++, C, Ruby, jQuery, signal processing, statistics, control theory, experimental design.**

Sentiment Analysis

- Built a Python framework for extracting tweets in a particular community to build a sentiment analysis model improving on the opensource AFINN model. Framework extends to any subject field with minimal modifications.
- Extracted tweets mentioning specific products related to the field and evaluate their sentiment using improved AFINN model.
- Built an interactive D3.js webpage using the Rickshaw framework to display sentiment timeseries associated to each keyword and summary statistics provided by the analysis.
- **Used Python, REST API, AFINN, JSON, Javascript, D3.js, Rickshaw, CSS, HTML, Awk, Sed, and BASH.**

Research

Noncommutative differential operators

- Proved that two classical results on quantum differential operators had a deep unknown connection.
- Proved a series of results on quantum differential calculus on quantum spaces.
- Proved theoretical results on the algebraic structure of quantum differential algebras and linear algebraic representations.
- **Used Category Theory, Higher Algebra, Algebraic Geometry, and Representation Theory**

Pictoral basis for the vector space of framed, linked, knots

- Invented a combinatorial algorithm to generate all possible diagrams representing knots with orientation and a finite number of pieces. Created mathematical and computational representations to efficiently store diagrams in memory for large-scale linear algebra operations.
- Implemented this combinatorial algorithm in JAVA, generated $>$ 1M new diagrams unknown to mathematicians.
- Wrote a data processing tool to convert this data to a million-entries sparse matrix.
- Wrote a batch file(Windows Script) to transfer this matrix into Mathematica for fast row-reduction and run on the computing cluster at KSU.
- Wrote a JAVA script to read this matrix output, isolate particular entries, reduce by a mathematical dependence relation, and draw the 2-dimensional diagrams associated to them.
- **Used advanced algebraic/combinatorial techniques, JAVA, Batch, Mathematica, Javascript.**

Education, Service, and Leadership

CommonCore Curriculum writer

- Designed and planned the curriculum for 11th grade mathematics for the national CommonCore education initiative.
- Wrote modules and exercise sets for teachers to use during classes.
- Led other writers to develop modules and exercise sets.
- **Used Sharepoint, Latex, Word.**

Graduate Teaching Assistant

- Taught undergraduate courses in mathematics, TA'ed graduate course in algebra, conducted qualifying exam study sessions for new graduate students.
- **Courses Taught: Single and Multi-variable calculus.**

Summer REU mentor

- Served as a research and technology mentor for undergraduates participating in the KSU NSF REUs in 2010, 2011.
- **Topics lectured: Algebraic Number Theory, Linear Algebra, Latex, Matlab.**

Special Summer Math lecturer

- Trained K-12 teachers on mathematics modules and applied mathematics examples for use in their classrooms.
- Wrote small programming scripts to extract data to connect the mathematics we were covering with current events.
- Wrote python scripts to scrape tweets and perform n-gram analysis, used R to plot the data, analyze it, and compare it to the classical version by Peter Norvig. Presented graphics generated at an R "graphics contest" on campus, got second place.
- Wrote a simulator to show the efficiency of binary vs linear search and related to translating morse code/decoding messages based on a tree representation.
- **Python, R, REST API, ggplot2.**

Organizer, KSU Algebra and Representation Theory Conference

- Organized subject matter, contacted invited speakers, determined schedule, contacted conference participants.
- Wrote CSS webpage, advertised on research boards/newsgroups.
- Organized KSU graduate students to carry out tasks during the conference, food, refreshments, excursions.
- **Used CSS, HTML.**