

# Rukmal Weerawarana

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## EDUCATION

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### Stevens Institute of Technology

*Master of Science in Financial Engineering*

*GPA: 3.71 / 4.00; Awards: Provost Master's Fellowship*

**Hoboken, NJ**

*Aug '17 - May '19*

### University of Washington

Michael G. Foster School of Business; Department of Finance and Business Economics

*Bachelor of Arts in Business Administration (Finance)*

College of Arts & Sciences; Department of Applied Mathematics

*Certificate in Quantitative Fundamentals of Computational Finance*

**Seattle, WA**

*Sep '13 - Jun '17*

## WORK EXPERIENCE

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### Sensorimotor Control Laboratory

Stevens Institute of Technology; Department of Biomedical Engineering

*Research Assistant*

**Hoboken, NJ**

*Aug '18 - Present*

- Designed and implemented algorithms to assess and classify tremor severity in patients with late-stage Parkinson's Disease.
- Provided input to hardware research based on statistical tremor analysis results with the goal of designing a complete low-cost system for tremor analysis. Contributed to additive manufacturing models and designing sensor arrays for a data collection glove to be used for tremor analysis.
- Created a web-based deployment architecture for the tremor analysis engine, including HIPAA-compliant data storage and access, and efficient cluster management with Docker and Kubernetes.
- Performed cost comparisons to identify the most economical Infrastructure-as-a-Service (IaaS) provider, given the storage and computation requirements of the solution stack.

### Rensselaer Polytechnic Institute

Department of Computer Science; IBM Research HEALS Center

*Research Assistant*

**Troy, NY**

*May '18 - Aug '18*

- Contributed to significant novel research in Artificial Intelligence - specifically in the space of Knowledge Representation (KR), as a part of the Health Empowerment by Analytics, Learning and Semantics (HEALS) Team in the Computer Science Department. The HEALS Project is a member of the [IBM Research AI Horizons Network](#).
- Formulated strategies for semantically-enhanced extraction of medical directives from various Clinical Practice Guidelines (CPGs), for eventual inclusion in a knowledge graph of Diabetes diagnosis and treatment directives. Built the *Guideline Explorer*, a tool for efficiently visualizing and examining the American Diabetes Association's 2018 Clinical Practice Guidelines.
- Developed the *Guideline Analysis Framework*; a mathematical formulation of CPGs that may be used to compare various CPGs addressing the same group of ailments, and to aid in the identification of potential disparities in the medical directives.
- Formulated an Electronic Health Record (EHR) simulation engine, which utilized Monte Carlo simulations based on a population heuristic to vary idiosyncratic patient attributes, creating a statistical prediction of medical tests to be conducted that are likely to identify previously-unknown medical conditions.
- Explored the field of *Semantalytics*, which is the intersection of Semantics and Analytics, with each informing the other in a symbiotic fashion. Drafted a Vision statement for the field of Semantalytics, through the context of simulated patient data.
- Designed and developed the *PaperRank Framework*, a methodology for deriving a probabilistic community trust score for academic publications utilizing the popular PageRank algorithm, coupled with a Gamma Mixture Model applied to entire academic citation graphs. Implemented a complete proof-of-concept from extraction to final trust computation with the [NCBI PubMed Database](#), analyzing over 14 Million academic publications.

**Hanlon Financial Systems Laboratory**  
Stevens Institute of Technology; School of Business  
*Laboratory Assistant*

**Hoboken, NJ**  
*Aug '18 - Dec '18*  
*Sep '17 - May '18*

- Assist in the daily operations of the lab, including maintaining existing software resources.
- Spearheaded an effort to discover and implement new technology solutions to help facilitate the teaching and research activities of the lab.

**UW Hyperloop**  
University of Washington; College of Engineering  
*Business Management Team Lead*  
*Impact Development Team Lead*  
*Controls Systems Team Member*

**Seattle, WA**  
*May '16 - Aug '17*

- Represented the University of Washington at the inaugural *SpaceX, Inc. [Hyperloop Pod Competition](#)* in Hawthorne, CA. The team placed 4th in the United States, and 6th globally. The competition received 1,700 team proposals, and 30 finalists.
- Led the Business Management Team to develop and deploy a highly successful crowdfunding campaign to raise over \$20,000 (with an initial goal of \$10,000), and source materials to engineer and construct one of the first-ever functioning Hyperloop Pods. The collective effort of the team led to us having the lowest-cost Pod among the 30 finalists.
- Spearheaded outreach to sponsors, collaborators, internal (UW) and external advisors.
- Facilitated the sourcing and delivery of over \$50,000 of raw material, including high-density Carbon Fiber, release agents, and powerful Neodymium magnets for the final Pod assembly.
- Assisted the Controls Team Lead in the final design and implementation of electronic mapping and wiring on the Pod.
- Contributed to late-stage troubleshooting efforts that led to the successful implementation of Halbach arrays, facilitating levitation and magnetic propulsion of the UW Pod.
- Explored the transformative economic and social effect a hypothetical Hyperloop system could have on the Pacific Northwest of the United States.

**Lunar CubeSAT Team - Advanced Propulsion Laboratory**  
University of Washington; Department of Earth and Space Sciences  
*Research Assistant*

**Seattle, WA**  
*Mar '15 - Jul '15*

- Designed a communications software architecture paradigm for the on-board processing systems of the [Lunar CubeSAT](#).
- Investigated the effect of radiation beyond the Van Allen belts experienced during translunar flight, and recommended ideal processor architectures and other redundant measures that may be taken to mitigate these effects.
- Proposed a system of Hamming coding to increase data transfer security during communications between the CubeSAT and a ground station at the University of Washington. Recommended specific data encoding algorithms to increase the data throughput of the Earth downlink from the CubeSAT.
- Presented final proposal to a panel of scientists at the Advanced Propulsion Laboratory and NASA. The UW Lunar CubeSAT is expected to launch as a secondary payload on NASA's Space Launch System (SLS) aboard the Orion Spacecraft.

**ZocialGPA, Inc.**  
Startup Company  
*Software Engineering Team Lead*

**Seattle, WA**  
*Feb '15 - Jan '16*

- Beginning as an intern, I went on to lead the full-stack team tasked with designing and implementing the full suite of ZocialGPA social analytics products.
- Designed a highly scalable and efficient software ETL stack, building datasets from various social networking platforms including Facebook, Twitter and LinkedIn. Created heuristics for efficient retrieval of this data from large, non-relational databases.

**WSO2, Inc.**  
Apache Stratos Team  
*Software Engineering Intern*

**Colombo, Sri Lanka**  
*Jun '14 - Sep '14*

- Investigated the viability of alternative hypervisor stacks for eventual integration with the [Apache Stratos](#) Platform-as-a-Service (PaaS) framework.
- Conducted isolated integration tests with the CoreOS+Docker (LXC-based) hypervisor stack as an alternative to the existing KVM hypervisor used in Stratos.
- Developed a new user interface for the Stratos Manager Console using the JaggeryJS MVC framework, which was packaged and shipped with Stratos version 4.1.0.

- Assisted the Lead Scientific Programmer of the lab in identifying and extracting sequences of mutated genes in human genome sequences, aiding in the creation of targeted retroviral therapies for patients with the Human Immunodeficiency Virus (HIV).
- Created efficient and scalable data traversal algorithms for the ingestion and transformation of large human genome sequences. Utilized *Hyperfreq*, a tool for Bayesian analysis of APOBEC3G-induced hypermutations to identify sequences of the genome likely to have been mutated.

## PUBLICATIONS

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### [In Progress] Inferring Community Trust from Citation Graphs

James P. McCusker, Rukmal Weerawarana, Alexander New, Kristin P. Bennett, Deborah L. McGuinness

<https://drive.google.com/open?id=1SlSfZrwOQYP0mrKbrGLjjAFzWCk-qlwm>

We introduce an algorithm based on PageRank to create a trust score from academic citation graphs that can be used as an approximation for the trust the research community has in each article. The initial PageRank scores (when applied to the citation graph; treating each citation as a link) are normalized to a desired range of probabilities using a one-dimensional Gamma mixture model. We evaluate our algorithm, PaperRank, using the NCBI PubMed citation graph. PaperRank scores correspond to expert evaluations of experimental methods for protein/protein interactions that we have previously used for successful probabilistic knowledge graph population. Furthermore, they also have a clear relationship to the reputation of different kinds of articles cited by Clinical Practice Guidelines. We conclude that PaperRank is a suitable proxy for the trust the research community places in its research, and how trustable a knowledge graph assertion can be that has been curated from that research. We further stipulate that the PaperRank metric can be used to effectively underwrite metadata-enriched knowledge graphs with a layer of probabilistic certainty for the assertions therein.

### [In Progress] What is a Knowledge Graph?

James P. McCusker, John S. Erickson, Katherine Chastain, Sabbir Rashid, Rukmal Weerawarana, Deborah L. McGuinness

<http://www.semantic-web-journal.net/content/what-knowledge-graph>

We survey the literature for current efforts to develop a comprehensive definition for a knowledge graph. We then use that review, along with work conducted at the IBM Research HEALS Center to synthesize a definition that is relevant and informative to current knowledge graph research, while constraining the research space that may be considered a knowledge graph. We define a knowledge graph as “A graph, composed of a set of assertions (edges labeled with relations) that are expressed between entities (vertices), where the meaning of the graph is encoded in its structure, the relations and entities are unambiguously identified, a limited set of relations are used to label the edges, and the graph encodes the provenance, especially justification and attribution, of the assertions.” We evaluate a variety of knowledge resources, graphs, and ontologies to determine if they qualify under our definition, and find that while expressing knowledge as a graph structure and unambiguous denotation of entities and relations in the graph are common, it is less common to trace provenance of encoded knowledge, and less common to constrain the relations used when expressing that knowledge. We created a [Knowledge Graph Catalog](#) to support this effort.

### Semantic Modeling of Cohort Descriptions in Research Studies

Shruthi Chari, Rukmal Weerawarana, Oshani Seneviratne, James P. McCusker, Deborah L. McGuinness, Amar Das  
*AMIA Knowledge Representation and Semantics Workshop. American Medical Informatics Association (2018)*

[https://tw.rpi.edu/web/doc/semantic\\_modeling\\_of\\_cohort](https://tw.rpi.edu/web/doc/semantic_modeling_of_cohort)

Clinical trial results and observational case studies are regularly cited by authors of Clinical Practice Guidelines (CPG) as scientific justification for treatment recommendations. Often, these research studies are based on highly selective populations that restrict sociodemographic or comorbid characteristics. This work addresses a key challenge faced by physicians using CPG recommendations; determining how well the study evidence generalizes to the general clinical population. Previous computer-based CPG models have been built in a depth-first manner by primarily modeling the semantics and structural design of the CPGs, and failing to capture the nature of the evidence used as provenance for the CPG recommendations. We address this limitation by modeling the patient attributes in cohort descriptions used in the underlying clinical studies, with the ultimate goal of enabling physicians to better tailor CPG recommendations to their patients.

## SELECTED KNOWLEDGE AREAS

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### Computer Science and Software Engineering

Cloud Computing, Distributed Systems, Scientific Computing, Scalable System Architecture and Design, Data Structures, Operating Systems, Object Oriented Design, Algorithms

### Data Analytics

Artificial Intelligence, Machine Learning, Knowledge Representation, Graph Analytics, Natural Language Processing, Semantic Analysis, Data Visualization

### Economics and Econometrics

Data Science and Econometrics, Microeconomics, Macroeconomics, Managerial Economics

### Finance

Computational Finance, Advanced Derivatives, Portfolio Theory, Market Microstructure, Corporate Finance, Banking Systems, Capital Budgeting, Fixed Income, Foreign Exchange Finance, International Finance, Financial Reporting and Managerial Accounting

### Mathematics

Advanced Probability Theory, Advanced Statistical Modeling, Graph Theory, Convex and Non-Convex Optimization, Stochastic Calculus, Time Series Analysis and Modeling, Logic, Combinatorial Mathematics, Multivariable Calculus, Differential Equations, Partial Differential Equations, Real Analysis, Linear Algebra

### Other

Quantum Computing, Orbital Physics, Genomics, Wave Theory, Quantitative Political Science, Sociology

## SKILLS

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### Programming and Scripting Languages

Python, R, Java, JavaScript, GoLang, Perl, Bash, LaTeX, HTML, CSS

### Standards, Databases and Frameworks

Node.js, Flask, Revel, Spring, ElectronJS, R Shiny, MongoDB, SQL, Redis, RDF, SPARQL

### Deployment, Orchestration and Continuous Integration Tools

Kubernetes, Docker, Amazon Web Services, Google Cloud Platform, Microsoft Azure, Travis CI, Shippable

### Machine Learning Tools and Frameworks

TensorFlow, scikit-learn, Theano, SciPy, Google Colaboratory, R Markdown, Project Jupyter

### Other Software and Operating Systems

Microsoft Office, Bloomberg Terminal, Adobe Creative Cloud, macOS, Linux (Ubuntu, RedHat, etc.), Windows

## SELECTED PROJECTS

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### [In Progress] EDGAR-kg and PyEDGAR (Python/Flask, RDFLib, SPARQL)

EDGAR-kg is a knowledge graph of financial data, built using the U.S. Securities and Exchange Commission's (SEC) Electronic Data Gathering, Analysis and Retrieval (EDGAR) system. I present an eXtensible Business Reporting Language (XBRL) and Financial Industry Business Ontology (FIBO) compliant ontology, on which data from EDGAR is imported and mapped. Data is extracted directly from the EDGAR, using the PyEDGAR API for Python. This is expected to enable a wide variety of analysis on reporting data.

### Lifestream API (GoLang/Revel, MongoDB)

Initially built for the Dubhacks Hackathon, Lifestream is a hyperlocal picture sharing application. We implemented applications for Android and iOS, which both use the same backend Lifestream API service.

### Derivative Visualizer (R/ggplot)

An R library for plotting simple profit/loss graphs for derivatives.

### UW Open Data (Python/Flask)

UW Open Data is a REST API for the University of Washington course catalog, built by scraping UW's existing web catalog.

### LeapPong (JavaScript/Node.js/Socket.io, Leap Motion Controller)

LeapPong is a peer-to-peer implementation of the infamous game *Pong*. It uses websockets to communicate between the server and up to two simultaneous players. Paddles are controlled with the Leap Motion controller, interfaced using the Leap Motion JS API.

**Rendezvous API (JavaScript/Node.js, MongoDB)**

Initially built for the Startup UW Hackathon, Rendezvous is a iOS application for intelligently scheduling and meeting up with friends, handling Facebook and Twitter authentication, session management and user data storage and processing in MongoDB.

**ColabLists (JavaScript/Node.js, MongoDB, Angular.js)**

Initially built for the Facebook Regional Hackathon, ColabLists is a platform for collaboratively making music playlists at parties. This API handles authentication, list building and ranking as well as providing a web interface for interacting with the application.

**FlappyLeapBird (JavaScript, Leap Motion Controller)**

Built an extension to Nebez Briefkani's web implementation of the *FlappyBird* game to control game assets with hand motions detected by the Leap Motion Controller.

**SpotifyInstant (JavaScript, HTML, CSS)**

Instant search for the Spotify music catalog, built using the Spotify REST API.

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**AWARDS AND CERTIFICATIONS****Stevens Institute of Technology Provost Master's Fellowship**

<https://www.stevens.edu/admissions/tuition-financial-aid/graduate-funding-aid/assistantships-fellowships>

Awarded to selected first-year Graduate students entering the Stevens Institute of Technology for graduate study.

**Hackathons**

Dubhacks 2015; *Dropbox API Prize*

StartupUW Hackathon; *2nd Place*

Facebook Regional Hackathon; *3rd Place*

**Bloomberg Market Concepts Certificate**

<https://www.bloomberg.com/professional/product/bloomberg-market-concepts/>

**International Baccalaureate Diploma - The British School in Colombo**

<https://www.ibo.org/programmes/diploma-programme/>

*Higher Level:* Mathematics, Physics, Chemistry; *Standard Level:* Geography, Spanish, English; *Extended Essay:* Electromagnetism

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**EXTRA-CURRICULAR ACTIVITIES****Recreational Sports**

Basketball, Ultimate Frisbee, Swimming, Running

**Conscious Crew Volunteer**

I volunteered at large concerts and music festivals in the Seattle area, acting as a first responders to potentially life-threatening incidents of over-intoxication and drug overdoses.

**University District Food Bank Volunteer**

I worked at the local food bank in the University District in Seattle to assist in moving to their new location, while also restocking shelves and assisting customers at check out.

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**CONTACT INFORMATION**

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