Jarrell Waggoner

Biographical

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Research Interests

computer vision, segmentation, contour completion, perceptual grouping, document image analysis, event recognition, image processing, artificial intelligence, pattern recognition & machine learning, data science, functional programming, GIS, Clojure

Education

Aug. 2013 — Doctor of Computer Science & Engineering — **University of South Carolina**
Advisor: Dr. Song Wang
Dissertation: "Multi-Label Segmentation Propagation for Materials Science Images Incorporating Topology and Interactivity"

May 2009 — Master of Engineering in Computer Science — **University of South Carolina**
GPA: 3.8/4.0 | *magna cum laude*

Industry Experience

2017—Present — **Principal Software Engineer** at Rally Health, Inc.

Individual contributor on the Data Infrastructure team, building tools and architecting data pipelines for Rally's reporting and Data Science needs.

- Architected complete rewrite of the data pipeline for the entire organization, moving from a fixed **Cloudera** cluster with a **Hive** EDW to dynamic clusters with **Databricks** with a **Redshift** EDW fed by **Spark** ETLs written in **Scala** and scheduled with **Airflow**.
- Coordinated with external vendors and internal teams ranging from Ops to Data Science to define and build new data pipeline, spearheading the CI approach, development and testing workflows, data ingestion process, EDW layout, monitoring/alerting, job scheduling, and data validation components.
- Member of the Engineering Technical Staff, responsible for making cross-cutting engineering decisions, evaluating potential acquisitions, signing off on major company-wide architectural changes, and organizing technical interest groups.
- Technical lead of eight person engineering team; responsible for working with Product and Project Managers to define and schedule work, standardize code review practices on the team, build consensus for new architectural approaches, reporting directly to VP-level management.

2016—2017 — **Software Engineer** at DRW Holdings, LLC

Member of the Trading Infrastructure team, developing the internal platform used by every trading desk at DRW. Built greenfield high-performance service-oriented systems using **Clojure** and **Java** while maintaining legacy applications in **Ruby** and **C#** among a catalog of over 50 microservices.

- Contributed to an extensive reconciliation tool used to balancing cashflows for high-volume trading, written in **Ruby**.
- Extended a research workflow tool used for computing the value and settle price of options, futures, equities, and other financial instruments, written in **Clojure**.

— Developed and extended multiple UI frontends for internal tools using **React** and **Reagent**.

2013—2016

Senior Software Engineer at Groupon, Inc.

Contributed to three engineering teams: The Flux team building Data Science pipelines, the Project Genesis strike team integrating scraped web data into **Salesforce**, and served as Tech Lead of the Supply Intelligence team creating internal sales tools to optimize Groupon's supply funnel.

— Built a **PostgreSQL**-backed high-performance caching and write management system in **Clojure** around the **Salesforce** API that hits 10K req/min.

— Managed critical business automation of the sales lead assignment process that previously required an estimated 80 sales managers to conduct manually; led the effort to rearchitect this legacy system from an ad-hoc job scheduling platform written in **Ruby** and **Bash** to a multi-staged **Hadoop** pipeline written in **Clojure** to handle over 6M accounts.

— Coordinated with product and business teams to ETL 250K leads in **Salesforce** from scraped web data.

— Built out an ETL management and machine learning platform using **Python**, **Clojure**, **Hive**, and **Spark** to run mission-critical Decision Tree Learning models to predict customer attrition, lifetime customer value, and merchant value.

— Mentored interns and junior developers, established best practices, and led multiple major technical initiatives on a team of 5 developers.

2012—2014

Technical Engineer at TerraStride, Inc.

Software developer in an agile startup environment creating the huntstand.com web application. Written using **Python**, **Django**, and **Backbone.js**; deployed to **AWS**. Responsible for curating full technology stack and coordinating with 5 developers.

2011—2013

Project Manager at Palmetto Computer Labs

Created and taught workshops on **git**, the **Linux** command line, **Android** development, and open source software for hundreds of students, developers, and government officials at IT-oLogy. Managed the Open IT Lab and associated projects. Assisted in planning POSSCON.

2011

Contractor for Elastic Vision Consulting

Built a parser and generator for **XML** medical records formats (CCR and CCD) in a **Java** web application. Written using **JDOM**, **Xerces**, and **Hibernate**, and run on an **Axis2+Jetty6** driven server.

Research Experience

2011—2013

Research Assistant funded by AFOSR

Materials Volume Segmentation

Developed segmentation methods for materials image volumes in *Python+NumPy/SciPy* and *MATLAB* at the Computer Vision Lab at USC. Managed the lab computer network and organized weekly lab meetings. Created GUI interface using wxWidgets for assisted segmentation, and conducted large-scale evaluations on multiple datasets for metallic and biological materials.

2010—2011

Research Assistant funded by DARPA

Video Event Recognition

Explored segmentation methods for video event recognition. Attended P.I. meetings in San Diego (2010) and Colorado (2011). Developed algorithms in *Scheme* to process a corpus of thousands of videos extracted into over 3 million frames using a high-performance computing cluster.

2009—2010

NEH Fellow at the Center for Digital Humanities

Digital Collation

Created a digital collation application to handle automatic differencing of sub-textual inconsistencies among multiple copies of *The Faerie Queene* by Edmund Spenser in *MATLAB* to process tens of thousands of book page images.

Teaching Experience

2008—2009	GK-12 Fellow at Crayton Middle School *8th Grade Science* Served in Crayton Middle School, coordinating with the classroom instructor to enhance the science curriculum and activities in an 8th grade science classroom. Subsequently coordinated and taught at the GK-12 Institute for Teachers, presenting the activities developed and delivered in the classroom.
2007—2008, 2011	Graduate Teaching Assistant at USC *Web Development* Supervised CSCE 145 labs, covering software development with Java, and taught CSCE 102, covering Javascript, HTML, and CSS. Taught CSCE 211 covering digital logic design.
Spring 2007	Instructor for CSCE 204 at USCL *Introductory Programming* Hired as special faculty. Taught introductory Visual Basic for majors and non-majors. Selected textbooks, developed all course material, graded all assignments. Worked with Dr. Noni M. Bohonak
Fall 2006	Camp Instructor for USCL Arts and Sciences Adventure Camp *5th-8th Grade Students* Worked in collaboration with Dr. Dwayne Brown. One of two instructors teaching Math and Computer Science to grade school students.
2003—2007	Professional Tutor at USCL Academic Success Center *High School and College Students* Student and graduate tutor for college-level Mathematics, Computer Science, Physics, and English classes.

Publications

[1] Derrick. C. Spell, Ling-Yong Wang, Richard T. Shomer, Bahador Nooraei, **Jarrell Waggoner**, Xaio-Han T. Zeng, Jae Y. Chung, Kai-Chen Cheng, and Daniel Kirsche. QED: Groupon's ETL management and curated feature catalog system for machine learning. In *IEEE International Conference on Big Data*, pages 1639–1646, Dec 2016. [Link].

[2] **Jarrell Waggoner**, Youjie Zhou, Jeff Simmons, Marc De Graef, and Song Wang. Topology-preserving multi-label image segmentation. In *IEEE Workshop on Applications of Computer Vision (WACV)*, pages 1084–1091, Waikoloa Beach, HI, 2015. [PDF].

[3] **Jarrell Waggoner**, Youjie Zhou, Jeff Simmons, Marc De Graef, and Song Wang. Graph-cut based interactive segmentation of 3D materials-science images. *Machine Vision and Applications*, 25:1615–1629, 2014. [PDF].

[4] Youjie Zhou, Lili Ju, Yu Cao, **Jarrell Waggoner**, Yuewei Lin, Jeff Simmons, and Song Wang. Edge-weighted centroid voronoi tessellation with propagation of consistency constraint for 3D grain segmentation in microscopic superalloy images. In *CVPR Workshop on Perception Beyond the Visible Spectrum (PBVS)*, 2014. [PDF].

[5] Dhaval Salvi, **Jarrell Waggoner**, Andrew Temlyakov, and Song Wang. A graph-based algorithm for multi-target tracking with occlusion. In *IEEE Workshop on Applications of Computer Vision (WACV)*, 2013. [PDF].

[6] Dhaval Salvi, Jun Zhou, **Jarrell Waggoner**, and Song Wang. Handwritten text segmentation using average longest path algorithm. In *IEEE Workshop on Applications of Computer Vision (WACV)*, 2013. [PDF].

[7] Andrew Temlyakov, Pahal Dalal, **Jarrell Waggoner**, Dhaval Salvi, and Song Wang. Shape and image retrieval by organizing instances using population cues. In *IEEE Workshop on Applications of Computer Vision (WACV)*, 2013. [PDF].

[8] **Jarrell Waggoner**. *Multi-Label Segmentation Propagation for Materials Science Images Incorporating Topology and Interactivity*. Dissertation, University of South Carolina, 2013. [PDF].

[9] **Jarrell Waggoner**, Jeff Simmons, Marc De Graef, and Song Wang. 3D materials image segmentation by 2D propagation: A graph-cut approach considering homomorphism. *IEEE Transactions on Image Processing*, 22, 2013. [PDF].

[10] **Jarrell Waggoner**, Youjie Zhou, Jeff Simmons, Ayman Salem, Marc De Graef, and Song Wang. Interactive grain image segmentation using graph cut algorithms. In *Proceedings of SPIE (Computational Imaging XI)*, Burlingame, CA, 2013. [PDF].

[11] Andrei Barbu, Alexander Bridge, Zachary Burchill, Dan Coroian, Sven Dickinson, Sanja Fidler, Aaron Michaux, Sam Mussman, Siddharth Narayanaswamy, Dhaval Salvi, Lara Schmidt, Jiangnan Shangguan, Jeffrey Mark Siskind, **Jarrell Waggoner**, Song Wang, Jinlian Wei, Yifan Yin, and Zhiqi Zhang. Video in sentences out. In *Conference on Uncertainty in Artificial Intelligence*, pages 102–112, 2012. [PDF].

[12] Andrei Barbu, Alexander Bridge, Dan Coroian, Sven Dickinson, Sam Mussman, Siddharth Narayanaswamy, Dhaval Salvi, Lara Schmidt, Jiangnan Shangguan, Jeffrey Mark Siskind, **Jarrell Waggoner**, Song Wang, Jinlian Wei, Yifan Yin, and Zhiqi Zhang. Large-scale automatic labeling of video events with verbs based on event-participant interaction. Technical report, 2012. [PDF].

[13] **Jarrell Waggoner**, Jeff Simmons, Marc De Graef, and Song Wang. Graph cut approaches for materials segmentation preserving shape, appearance, and topology. In *International Conference on 3D Materials Science*, pages 147–152, Seven Springs, PA, 2012. [PDF].

[14] **Jarrell Waggoner**, Jeff Simmons, and Song Wang. Combining global labeling and local relabeling for metallic image segmentation. In *Proceedings of SPIE (Computational Imaging X)*, volume 8296, Burlingame, CA, 2012. [PDF].

[15] Zhiqi Zhang, Sanja Fidler, **Jarrell Waggoner**, Yu Cao, Sven Dickinson, Jeffrey Mark Siskind, and Song Wang. Superedge grouping for object localization by combining appearance and shape information. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 3266–3273, Providence, RI, 2012. [PDF].

[16] Song Wang, **Jarrell Waggoner**, and Jeff Simmons. Graph-cut methods for grain boundary segmentation. *JOM Journal of the Minerals, Metals and Materials Society*, 63:49–51, 2011. [PDF].

[17] Andrew Temlyakov, Brent C. Munsell, **Jarrell Waggoner**, and Song Wang. Two perceptually motivated strategies for shape classification. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 2289–2296, 2010. [PDF].

[18] Zhiqi Zhang, Yu Cao, Dhaval Salvi, Kenton Oliver, **Jarrell Waggoner**, and Song Wang. Free-shape subwindow search for object localization. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1086–1093, San Francisco, CA, 2010. [PDF].

Posters/Presentations

[P1] Rules engines: Logic as data structure. *Palmetto Open Source Software Conference.* Columbia, SC. April 2015. [Slides].

[P2] Python for computer vision. *All Things Open.* Raleigh, NC. October 2013. [Slides].

[P3] Interactive grain image segmentation using graph cut algorithms. *USC Graduate Student Day.* Columbia, SC. April 2013. [Slides].

[P4] Computer science: Research, industry, and entrepreneurship. *Careers in Science Lecture Series.* Lancaster, SC. March 2013. [Slides].

[P5] Extending django. *Palmetto Open Source Software Conference.* Columbia, SC. March 2013. [Slides].

[P6] Interactive grain image segmentation using graph cut algorithms. *SPIE (Computational Imaging XI).* Burlingame, CA. February 2013. [Slides].

[P7] Android application development workshop. *Appathon Contest.* Columbia, SC. November 2012.

[P8] Homeomorphic multi-structure propagation for metallic image segmentation. *Gamecock Computing Research Symposium*. Columbia, SC. October 2012.

[P9] Open source and education. *SC Municipal Technology Association (SCMTA) Conference*. Charleston, SC. September 2012.

[P10] Open source and higher education. *SC Technical College System (SCTCS) Conference*. Columbia, SC. September 2012.

[P11] Introduction to android development. *Digital Humanities High Performance Computing (DHHPC) Workshop*. Columbia, SC. August 2012.

[P12] Combining global labeling and local relabeling for metallic image segmentation. *SPIE (Computational Imaging X)*. Burlingame, CA. January 2012.

[P13] Open source and government. *SC Government Management Information Systems (SCGMIS) Software Developers Workshop*. Columbia, SC. January 2012.

[P14] Superpixel contour completion. *DARPA Mind's Eye PI Meeting*. Denver, CO. January 2011.

Honors/Awards

First Place	»	Gamecock Computing Research Symposium Poster Session	*2012*
First Place	»	Graduate Student Day Presentation	*2012*
Second Place	»	Graduate Student Day Presentation	*2011*
Honorable Mention	»	Graduate Student Day Presentation	*2010*
Inductee	»	Upsilon Pi Epsilon	*2009*
Recipient	»	Clara P. Hammond Award	*2004*
Recipient	»	Science and Mathematics Award	*2004*
Recipient	»	Highest Academic Average Award	*2004*

Classes Taught

IT-oLogy				
	2012—2013	»	Open Source 101	Open Source Software
	2012—2013	»	Version Control 101	git, github
	2012—2013	»	Command Line 101	Linux, BASH
USC				
	Fall 2011	»	CSCE 211	Digital Logic Design
	Summer II 2008	»	CSCE 102	HTML/CSS/JavaScript
	Spring 2008	»	CSCE 145 Lab	Java
	Fall 2007	»	CSCE 145 Lab	Java
USCL				
	Spring 2007	»	CSCE 204	Visual Basic
	Spring 2007	»	Math 241 & Math 242	Maple

Service

Mentor	»	Groupon internship program	*2014*
Book Reviewer	»	Practical Data Analysis, Packt Publishing	*2013*
Webmaster	»	Winter Vision Meetings	*2013*

Webmaster »	Workshop on the Applications of Computer Vision	*2013*
Judge »	Discovery Day — Undergraduate Research Presentations	*2012*
Reviewer »	Pattern Recognition Letters	*2011—2012*
Reviewer »	IEEE Transactions on Pattern Analysis and Machine Intelligence	*2012*
SysAdmin »	Computer Vision Lab	*2009—2012*

Personal and Open Source Projects

matsciseg

Framework for propagated 3D volume segmentation, used in my dissertation work. Algorithms created in **Python** and **C++** and exposed as a web API using **Django**. Includes a web application that consumes the API created in **JavaScript**, and **jQuery**.

github.com/malloc47/matsciseg

Ratio Contour

Maintainer and contributor for the Ratio Contour project, a salient object detection and segmentation method used for computer vision applications. Developed in **C** and **MATLAB**.

github.com/malloc47/ratio-contour

Digital Collation

Research project to "collate" high-resolution documents by using image registration, accomplished using the SIFT feature detector and a thin plate spline warping technique, written in MATLAB.

github.com/malloc47/digital-collation

matscicut

An energy minimization framework for segmenting 3D materials volumes. Prototype of dissertation work, created in C++ using OpenCV libraries, with assorted MATLAB helper utilities.

github.com/malloc47/matscicut

befunge.py

Complete Befunge interpreter written in **Python**. Implements the Befunge 93 specification, and is one of the closest Python equivalents to the **C** reference implementation.

github.com/malloc47/befunge.py

Skills & Languages

••• Bash	••• git	•• JavaScript	••• PostgreSQL
•• C/C++	••• GNU/Linux	•• LaTeX	••• Python
••• Clojure	••• Hadoop	•• MATLAB	••• Scala
•• Django	• Haskell	••• NumPy/SciPy	••• Scheme
•• Emacs Lisp	••• Java	••• OpenCV	••• Spark

• Small-scale or personal projects •• Used in production ••• Used in large-scale production systems

Activities

teaching, open source software, GIS visualization, Linux, music composition