

# Computer Science- *Engineering with a Purpose!*

## Robot Invasion

Students in Dr. Chris Smith's "Introduction to Robotics & Computer Vision" course are getting a hands-on approach to these two fields. Each student is provided with a BOE-Bot at the start of the term to use for assignments and the term project.

The BOE-Bots can be equipped with sensors that include ultrasonics, temperature, humidity, GPS, motion, and acceleration. Some of the BOE-Bots can have cameras, RFID readers, and Bluetooth. Students are learning the real-life applications of computer vision and robotics in military mine detection, civilian safety and even environmental issues.



## Senior Design Teams

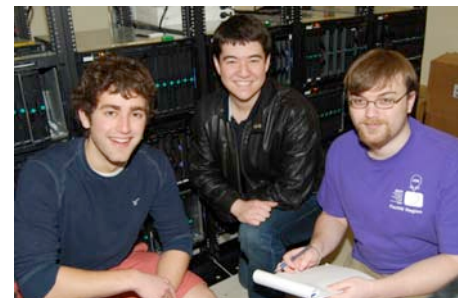
### **B-Hive Test: Rob Nertney, Scott Pfeifer, Matthew Strohmeyer**

This team is working with Boeing engineers to test an API they've developed. The team uses the software to collect large amounts of data from the City of Spokane Waste Management garbage trucks. They are coordinating with the GU Sociology department to compare fuel usage and human behavior in hopes of increasing the efficiency of the fleet of solid waste removal vehicles.

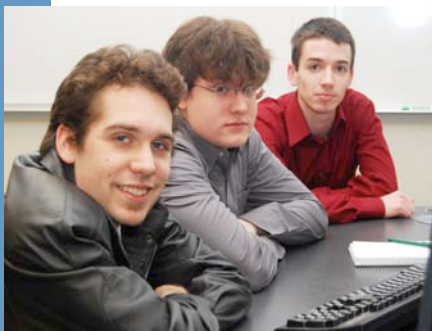
**Matthew Strohmeyer, Rob Nertney,  
Scott Pfeifer**

### **Power Data: Justin Funston, Jay Kudo, Michael Lavrisha**

The PowerData Corporation makes a product known as the PowerData Power Simulator. This software is vital to the power industry to train power system operators for emergency conditions. The team is developing a load-balancing, parallel version of this software using the in-house Linux cluster. The goals for this project are to allow a greater amount of users to operate concurrently, to automate the software to duplicate when overloaded, and to increase overall performance by reducing the amount of updates to the database through a merge and filter scheme.



**Michael Lavrisha, Jay Kudo, Justin  
Funston**



### **IT-Lifeline: Andrew Edwards, Joshua Hamblen, Elliot Kraber**

IT-Lifeline provides emergency data restoration for businesses who have suffered losses through natural or manmade disasters. The GU team is helping develop a website which will allow their salespeople access to a communal database for accurate quotes. This will clean up the inconsistencies in the creation of quote generation. It will also allow for different levels of users to have different levels of access to change pricing for a single quote. The quote generation system is being left open for possible expansion of the company which would allow for multiple sites to add their own resources and be sold separately through the same salespeople.

**Andrew Edwards, Joshua  
Hamblen, Elliot Kraber**

# Faculty Research

*Students work closely with faculty on research opportunities that undergraduates rarely receive.*

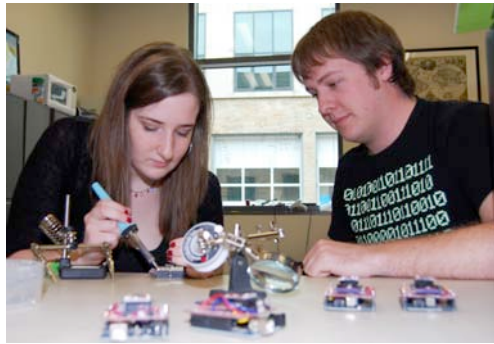


## Publications:

- Anand, M., **Bowers, S.**, Ludaescher, B. A navigation model for exploring scientific workflow provenance graphs. *Proceedings of the Workshop on Workflows in Support of Large-Scale Science (WORKS)*, ACM Press, 2009
- Anand, M., **Bowers, S.**, McPhillips, T., Ludaescher, B. Efficient provenance storage over nested data collections. *Proceedings of the International Conference on Extending Database Technology (EDBT)*, ACM Press, pp. 958-969, 2009
- Anand, M., **Bowers, S.**, McPhillips, T., Ludaescher, B. Exploring scientific workflow provenance using hybrid queries over nested data and lineage graphs. *Proceedings of the International Conference on Scientific and Statistical Database Management (SSDBM)*, LNCS vol. 5566, pp. 237-254, 2009
- Bassiri, E., Bryant, R., George, M., **Yerion, K.** (2009) *A Finite Difference method for modeling the formation of animal coat patterns*. *Nonlinear Analysis Real World Applications* 10(2009) 1730-1737
- Berkley, C., **Bowers, S.**, Jones, M., Madin, J., Schildhauer, M. Improving data discovery for metadata repositories through semantic search. *Proceedings of the International Conference on Complex, Intelligent and Software Intensive Systems (CISIS)*, IEEE Press, pp. 1152-1159, 2009
- Bowers, S.**, Madin, B., Schildhauer, M. *Owlifier: Creating OWL-DL ontologies from simple spreadsheet-based knowledge descriptions*. *Ecological Informatics* 5(1):19-25, 2010
- De Palma, P.** (2010). *Syllables and Concepts in Large Vocabulary Continuous Speech Recognition*. Dissertation, Department of Linguistics, University of New Mexico
- De Palma, P.**, Luger, G. (under review). Metathesis in English and Hebrew: A Computational Account of Usage-Based Phonology. *CogSci 2010, The 32<sup>nd</sup> Annual Meeting of the Cognitive Science Society*, Portland
- De Palma, P.** (ed.). (2009). *Computers in Society 10/11*. Dubuque, Iowa: Dushkin/McGraw-Hill
- De Palma, P.** (2009). Chapter 28: Genetic and Evolutionary Computing. In G. F. Luger, W. A. Stubblefield. *Artificial Intelligence Programming in Prolog, Lisp, and Java*. NY: Addison-Wesley
- Jones, T., Tompkins, R., Nertney, R., **Smith, C.**, **Crowley, P.** Reconfiguration without Reprogramming in Wireless Sensor Networks. To be submitted. *31st IEEE Real-Time Systems Symposium*, 2010
- Ludaescher, B., **Bowers, S.**, McPhillips, T. *Scientific workflows*. *Encyclopedia of Database Systems*, Springer, pp. 2507-2511, 2009
- Ludaescher, B., Weske, M., McPhillips, T., **Bowers, S.** Scientific Workflows: Business as usual? *Proceedings of the International Conference on Business Process Management (BPM)*, LNCS vol. 5701, pp. 31-47, 2009
- McPhillips, T., **Bowers, S.**, Zinn, D., Ludaescher, B. *Scientific workflow design for mere mortals*. *Future Generation Computer Systems* 25(5):541-551, 2009
- Schaub, H., **Smith, C.** Statistical Color Models in Active Deformable Models for Dynamic Lighting Conditions. In revision, 2010
- Smith, C. Segmentation and Tracking of Natural Patterns Using Fractal Snakes. *Submitted IEEE International Conference on Systems, Man and Cybernetics*. 2010
- Thau, D., **Bowers, S.**, Ludaescher, B. Merging sets of taxonomically organized data using concept mappings under uncertainty. *Proceedings of the International Conference on Ontologies, DataBases, and Applications (ODBASE)*, LNCS vol. 5871, pp. 1103-1120, 2009
- Thau, D., **Bowers, S.**, Ludaescher, B. *On merging taxonomies under RCC-5 algebraic articulations*. *Journal of Computer Science and Engineering* 3(2):109-126, 2009
- Yerion, K.** Curriculum module, *How Animals Get Their Stripes*, Northwest Distributed Computer Science Department, National Science Foundation grant, [http://ai.vancouver.wsu.edu/~nwdcsd/wiki/index.php/How\\_animals\\_get\\_their\\_stripes](http://ai.vancouver.wsu.edu/~nwdcsd/wiki/index.php/How_animals_get_their_stripes)
- Yerion, K.** Computational artifact for solving a system of partial differential equations (called reaction-diffusion equations) *How Animals Get Their Stripes*, [http://ai.vancouver.wsu.edu/~nwdcsd/wiki/index.php/How\\_animals\\_get\\_their\\_stripes](http://ai.vancouver.wsu.edu/~nwdcsd/wiki/index.php/How_animals_get_their_stripes)
- Yerion, K.** How animals get their stripes -- a teaching module for numerical analysis, *Mathematical Association of America*, August 2009
- Yerion, K.** How animals get their stripes -- a teaching module for courses in numerical analysis and differential equations, *Spokane Regional Mathematics Colloquium*, October, 2009
- Zinn, C., **Bowers, S.**, Kohler, S., Ludaescher, B. *Parallelizing XML data-streaming workflows via MapReduce*. *Journal of Computer and System Sciences (JCSS)*, 2010
- Zinn, D., **Bowers, S.**, McPhillips, T., Ludaescher, B. X-CSR: Dataflow optimization for distributed XML process pipelines. *Proceedings of the International Conference on Data Engineering (ICDE)*, IEEE Press, pp. 577-580, 2009
- Zinn, D., **Bowers, S.**, McPhillips, T., Ludaescher, B. Scientific workflow design with data assembly lines. *Proceedings of the Workshop on Workflows in Support of Large-Scale Science (WORKS)*, ACM Press, 2009

# Student Research

Thomas Jones (2010), Reed Tompkins (2010), Robert Nertney (2010) and Josie Hunter (2011) are working on a way to help application developers enforce power-management policies on wireless sensor networks. With direction from Dr. Patricia Crowley and Dr. Chris Smith, they developed a framework that reprograms wireless sensor networks quickly and efficiently.



*Rob Nertney shows junior Josie Hunter how to prepare the sensors used on City of Spokane garbage trucks.*

This work also provides a way of deploying an application on a heterogeneous set of small embedded devices and allows the system to tune the programs adaptively to reduce power usage. The team submitted their research entitled “Reconfiguration in Heterogeneous WSNs for Power-Aware Policy Enforcement” to Sensor Networks 2010.

Justin Funston (2010), Tyler Carrington (2011) and Andrew Pierce (2012) are working to make the Internet faster for some applications. The prototype system will be demonstrated at NASA’s Ames Research Center. With guidance from Dr. Crowley and Matt Bergman, the team has written firmware, a device driver, a new protocol stack in the kernel, an application library and a test application. The entire system allows data to pass directly from the

hardware to the application space so there is less traffic in the CPU and the data can arrive faster and possibly with a higher bandwidth. Working with Argonne National Labs and a small hardware startup, the team is attempting to reach 40Gb/s Ethernet bandwidth.

Andrew Rueckert (2010), Thomas Jones (2010), Reed Tompkins (2010) and Bryan Chase (2010) are investigating using Intrusion Detection Systems to track work in data centers. The project will provide a method for tracking work per unit of energy. This is one of the open areas of research in GreenIT.



*Thomas Jones discusses research with Dr. Crowley*

## Welcome Dr. Bowers!



The Computer Science Department welcomes new Assistant Professor Shawn Bowers, PhD. Dr. Bowers brings a strong research background with experience as a Project Scientist at the UC Davis Genome Center in the Data and Knowledge Systems Lab and as a Postdoctoral Researcher at the San Diego Supercomputer Center at UCSD.

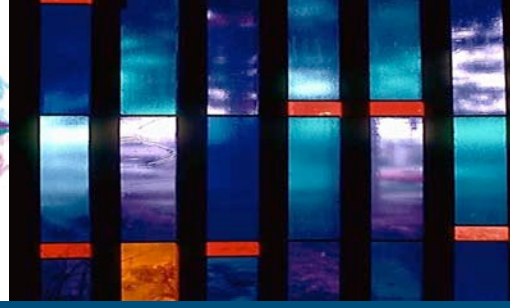
Dr. Bowers research interests are in the areas of database technology (conceptual modeling, data discovery, data integration) and scientific data management (observation models and scientific workflows). He is currently involved in the NSF-funded SONet, Semtools, and Kepler/CORE projects, where he is developing approaches for effectively representing and querying observational data and scientific workflow provenance.

## Best Wishes Matt!

Matt Bergman is leaving Gonzaga to move to Portland to coordinate the technical aspects of his family business. Matt graduated from Gonzaga with a degree in Computer Engineering in 2006 and has been an invaluable asset in setting up the Intel Corporation Computational Science Laboratory computer cluster and keeping the CS labs updated. He also was active in research and cowrote the paper “Virtualization and Low Cost Compute Labs”. We will miss his creativity and expertise!



*Dr. Crowley & Matt Bergman*



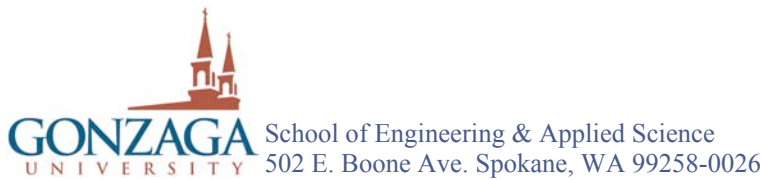
## Recent Student Research

Thomas Jones (Computer Engineering- CPEN) and Sean Dardis (Computer Science-CS) worked on an algorithm for hierarchical data compression in wireless sensor networks under stress. The project was under the Department of Threat Reduction Agency (DTRA) grant with Dr. Crowley.

Rob Nertney (CPEN) and Thomas Jones (CS) worked on implementing a wireless sensor network in the Biology Department's greenhouse to monitor environmental conditions. The research centered on whether the network can accurately predict a switch in tasks from environmental monitoring to object tracking. Their research was also funded by the DTRA grant.

Justin Funston, Tyler Carrington and Ryan King (all CS) designed an application library and Linux driver module to use with a Splintered TCP engine using algorithms invented by Dr. Crowley. The engine, and the system software to support the engine, are expected to reach throughput levels around 80Gbps making it one of the first 100Gbps network interface cards. The network card and system software will be presented at NASA. The research was funded by a National Science Foundation SeaFire grant with Dr. Crowley.

Andrew Rueckert (CPEN) worked on a machine learning project at the Oregon Graduate Health Sciences Institute (formerly OGI). The opportunity came through Andrew's work with the Gonzaga Center for Evolutionary Algorithms (GUCEA).



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