# IGEM# 16-01

## *Computer Science at Boise State University:*
## *An Investment in Idaho's Future*
### *1st July 2015 – 30th June 2016 Annual Report*

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## Computer Science at Boise State University:
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# IGEM 16-01: Computer Science at Boise State University: An Investment in Idaho's Future
### 1st July 2015– 30th June 2016 Annual Progress Report

## Project Summary

The Idaho Global Entrepreneurial Mission (IGEM) and State Board of Education Higher Education Research Council (HERC) have provided three years of funding to continue the strategic forward momentum of the Boise State University Computer Science Department to help meet compelling state economic development, research, and workforce needs.

This progress report summarizes the activities during the first year of the project.

## Project Accomplishments

The project plan identified four primary strategies to achieve this goal:

1. *Sustain current faculty lines and continue forward trajectory.*
2. *Increase partnerships with local companies to facilitate knowledge development and transfer*
3. *Increase CS related research and economic development activity.*
4. *Produce more computer science graduates that qualify for software and related technical positions in Idaho*

Progress to date toward implementing these strategies is detailed in the following subsections.

### Strategy One: Sustain Current Faculty Lines and Continue Forward Trajectory

The Computer Science Department was successful in hiring and retaining five faculty members using the original IGEM grant (one full professor, two associate professors, one assistant professor and one clinical professor) – Dianxiang Xu, Vijay Dialani, Steve Cutchin, Elena Sherman and Jim Conrad. Three of the faculty are in the area of software engineering while one is in the area of data science and databases and another in visualization. Dr. Jim Conrad has been moved to another line and the others are being supported by the IGEM grant.

Dr. Vijay Dialani left for industry (LinkedIn) in August, 2015. The department was able to hire Dr. Edoardo Serra to take his place in August, 2015. He received his PhD in Computer Science from the University of Calabria, Italy in 2012. Since then he has held research positions at UCLA and University of Maryland. Dr. Serra's expertise is in the field of Data Science with applications in precision agriculture, cybersecurity, data-privacy, and national security. His expertise also includes probabilistic models, optimization, databases, and artificial intelligence. He has taken the lead role for the IGEM project that

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Dr. Dialani had started in collaboration with Simplot and built up a research lab with four graduate students and a post-doctoral researcher.

Another strong impact of the IGEM grant has been in the additional hiring that the department has done in the last six months. Using the eight lines provided by JFAC funding, the department has **successfully hired eight faculty in the past academic year**. That is a total of nine faculty hired in one year (including the replacement for Dr. Dialani). In each case, the faculty hired were the top choices in the respective areas of research from a total of 285 applicants. Given the extremely competitive nature of hiring in computer science, that has been very gratifying. The list of the new faculty is shown below (with the PhD granting University in parentheses).

- *Data Science*: Dr. Edoardo Serra (University of Calabria, Italy),
  Dr. Francesca Spezzano (University of Calabria, Italy)
  Dr. Casey Kennington (Bielefeld University, Germany)
- *Cyber Security*: Dr. Gaby Dagher  (Concordia University, Canada),
  Dr. Jidong Xiao (College of William and Mary)
  Dr. Yantian Hou (Utah State University)
- *Human Computer Interaction*: Dr. Jerry Fails (University of Maryland),
  Dr. Michael Ekstrand (University of Minnesota)
- *High Performance Computing*: Dr. Cathy Olschanowsky (University of California, San Diego)

## Strategy Two: Industry Partnerships

The CS Department continues to increase its formal and informal connections with industry and the IGEM hires are integral to the following initiatives and connections.

*Growing partnerships with industry*. Boise State University will support and encourage CS faculty to establish partnerships with industry via joint research projects, service on industrial boards, consulting and faculty and student involvement.  We have several ongoing examples of faculty working with our industry partners:

- In the past year Dr. Tim Andersen has worked as a consultant at Micron, and is also currently working as a consultant at AppDetex, a local startup company.
- Dr. Sole Pera is working on the advisory board at ReleVent City, a recent Boise startup.
- Dr. Sole Pera has also volunteered as an advisor/mentor for B-launch.
- Dr. Steve Cutchin is working as a consultant for Digital Mechanics, a 3D capture and reconstruction startup.
- Drs.  Serra, Spezzano, Andersen, Cutchin, and Jain are working with the J.R. Simplot Co. on a joint IGEM funded research project in Precision Agriculture, helping them to fuse information from multiple sources (such as historical yield data, satellite imagery, sensor data, and etc.) to assist farmers in intelligent decision making. This project also involves multiple graduate students and a post-doc.  This collaborative effort is leading to additional collaborative projects and proposals, with proposals involving Simplot submitted to NSF's PFI:BIC tracks.

- During the reporting period Dr.s Andersen, Cutchin, Jain, Serra, and Spezzano worked on submitting a $2.5m grant proposal from NSF's CISE:CRI track.  This grant involves industry partners Micron, HP, and Data Vortex.  It also involves researchers from Rice University, Georgia Tech, and Indiana University.
- 7 Industry partners committed to donate an additional $140,000 to the Expand.CS Scholarships program, which has allowed us to offer 21 scholarships to students for the 2016-2017 academic year.  These scholarships are designed to encourage and help students to finish their degree faster.  The industry partners who donated are AppDetex, Clearwater, Cradlepoint, HP, Impact Sales, MetaGeek, and Whitecloud.

*Community Events*. The CS Department continues to host *Boise Code Camp* and participate in *develop.idaho* and *Hackfort* to strengthen connections with industry and entrepreneurs. Code camp has grown to over 1000 participants in 2015 and 2016. It is now the largest code camp in the Northwest.  Hackfort has grown and will partner with Develop Idaho this year to host a combined event.

*Senior Design Projects*.   **The senior capstone projects, which are sponsored by local industry partners, has grown 50% in the last year, from 10 in academic year 2014, to 15 this academic year**.  We are working with companies from multiple sectors including high-tech, health care, government, finance, transportation, marketing, merchandising and agriculture.  The companies who are sponsoring projects include: BoomBoxBody, toGetHEROut.com, TransitFox, Willoop, RecallInfoLink, Zamzows, Clearwater Analytics, Kairosys.net, Noteworthy Recruiting, Whitecloud Analytics, WinCo, and zData.

*Industrial Advisory Board.* Alden Sutherland, VP and Chief Information Security Officer at AmerisourceBergen (a Fortune-16 company that recently bought multi-billion dollar local company MWI), currently heads the board. The board meets at least twice yearly with the department and provides feedback and strong support for curriculum, facilities, and hiring. Fasial Shah, a leading entrepreneur in Boise, has also joined the board.

## Strategy three: Increase research
The rate of research grant submissions and awards continue to increase, with **31 submitted** grants and **7 funded** during the 2015-2016 academic year.  **The seven funded awards total $1.2 million**. Six of the seven awards have PI or Co-PIs that are faculty associated with the HERC IGEM grant**.  During 2013-2016 (spanning the HERC IGEM first and the first year of the second award), the average funding level per year has been 23x more than in the three years preceding it**, a dramatic evidence of the impact of the IGEM award.

We were visited by program reviewers for the interdisciplinary PhD in Computing in December of 2015, and received a very positive review.  The PhD program is moving forward and will be submitted before the State Board of Education in April of this year.  The program will have tracks in CS, Cyber-Security, and Computational Science and Engineering, and with an eventual track in Big Data Analytics.

Dr. Andersen also worked with Dr. Kevin Learned, director of Boise State Venture College, to promote entrepreneurship amongst CS students. Dr. Learned and members of his team were invited to present

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to the senior capstone students, as well as were invited to present to several other courses in Computer Science. Dr. Learned promoted an option within the senior design project sequence for interested students to start and work on their own company, and also promoted the venture college experience to 100s of our students in different courses.  Several students have now signed up with the venture college.  We also count 7 startups that involve our faculty or students in some capacity.

## Strategy Four: Enhancing the Student Pipeline

The changes made in the lower division curriculum have resulted in higher retention. Specifically we have gone from 65% to 85% retention in the CS1 (Computer Science I, CS 121) course and the effects have percolated up the course sequence. During the first IGEM grant, we were able to double the number of bachelor's degree graduates (from 25 to 47). **The upward trend continues as the number of graduates has increased to 67 this year, a 268% increase from three years ago!**

Another important data point comes from course-pairing. In this analysis, we examined the pass rate of CS1 students in the subsequent CS2 course (sophomore level Computer Science II, CS 221). Historically, 78% of the CS1 students passed CS2. **With the improvements in the CS1 course, 90% of the new batch of students passed CS2, a significant uptick.** This data was collected over four semesters of the new courses versus ten years of the older style courses. This research was highlighted by the NSF WIDER PERSIST research grant last semester in their annual report and the CS department was asked to present a testimonial to their advisory board. The faculty is now propagating the new styles of teaching and learning to more courses in the curriculum.

With the hiring of new faculty, the department is now also working on developing a PhD program as mentioned earlier. The PhD program has the potential to significantly increase the research profile of the department and to draw top-notch talent to come to Boise State University and potentially end up in local industry.

The IDoCode project (funded by the National Science Foundation) to introduce high quality computer science in high schools is also progressing well in its second year. We now have 40 teachers in two cohorts and are recruiting for the third cohort to start in late Summer'2016. These teachers will offer fourteen new sections of AP Computer Science Principles course in Fall'2016. This new national course is designed to get a diverse group of students excited about computer science, which will lead to a bigger and better-prepared pipeline of students going on to college.

## Future Plans

The department is well on its way to further sustained growth in all areas. *We expect the number of graduates to be hitting a 100 in two years! T*he research activity is staying at an all time high level and the interaction with industry continues to increase.

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## Faculty and Student Participation

Five faculty and six graduate research assistants were supported directly on this grant. The supported faculty has in turn worked with more students and staff because of grants they received. Three graduate students that were working with the faculty that has left are now working now with two other new faculty: Dr. Sole Pera and Dr. Francesca Spezzano. As a result there were a total of **seven faculty, 39 students and one post-doc** that were supported directly or indirectly (excluding the three PIs). Additionally, 7 students have started internships at local companies because of the renewal of the Expand.cs program this fall.

| Name | Undergraduate | Graduate | Post-docs |
|------|---------------|----------|-----------|
| Steve Cutchin | 6 | 4 | 0 |
| Edoardo Serra | 0 | 4 | 1 |
| Elena Sherman | 0 | 2 | 0 |
| Dianxiang Xu | 6 | 7 | 0 |
| Others | 7 | 3 | 0 |
| **Total** | 19 | 20 | 1 |

## Patents and Copyrights

There are no patents or copyrights to report at this time.

## Startups and Technology Licenses

CS faculty were directly involved in two new startups:

- SilVR City Productions, where Dr. Steve Cutchin is the President and founder along with one co-founder. SilVR City is a Virtual Reality production company based on the technology developed in Dr. Cutchin's lab.
- relEVENTcity, is a five-person Boise tech-start up building a mobile event recommendation application.  Dr. Sole Pera is on their advisory board and is a shareholder. Her research is directly applicable to the startup.  relEVENTcity recently won the Boise Metro Chamber of Commerce blaunched competition, presented its work at an international recommendation conference (RecSys) in Vienna, Austria last month, presented at the Boise Metro Annual Economic Summit, and was recently featured in the Boise Weekly and Idaho Business Review.

Students were directly involved in the following five new startups, supported by Co-PI Jim Conrad via the Senior Design course. Several of these startups are in conjunction with Boise State Venture College.

- BoomBoxBody.com — Boise startup.  Social workouts.
- toGetHEROut.com — Athletic activities for women.
- Willoop — An LLC startup working on a Living Will service/apps

- Kairosys.net — Startup in Agriculture Decision Support Solutions.
- Noteworthy Recruiting — Boise startup that matches high school musicians with their preferred college marching bands.

## Expenditure Report

Six faculty and six graduate assistants were directly supported via the IGEM grant during this period.

| Budget for July 2015 to June 2016 | | | | |
|---|---|---|---|---|
| **Category** | **Salary** | **Fringe** | **Tuition** | **Total** |
| Faculty | $415,796.82 | $124,815.74 | | $540,612.56 |
| Graduate Assistants | $123,703.03 | 13,645.41 | 22,039.00 | $159,387.44 |
| | **$539,599.85** | **$138,461.15** | **$22,039.00** | **$700,000.00** |

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