

Report of the Program Performance Review Team

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Program Performance Review (PPR) Team Analysis

Introduction

This report is submitted by the 2021-22 Program Performance Review (PPR) team for the MS degree program in Computer Science at California State University, Fullerton. It describes the PPR team's assessment of the program based on the site visit on February 25, 2022 and the self-study report provided by the department of Computer Science (CS). The site visit included meetings, interactions, presentations, and lab visits, as summarized below:

- Presentation by Dr. Kevin Wortman, CS faculty member in-charge of presenting the self-study report
- Presentation by Dr. Mikhail Gofman, Graduate Adviser, Computer Science department
- Interaction with faculty panel consisting of Dr. Kevin Wortman, Dr. Mikhail Gofman, Dr. Anand Panangadan, and Dr. Doina Bein
- Interaction with Dr. Chang-Hyun Jo, Chair, Computer Science department
- Interaction with Dr. Susamma Barua, Dean, College of Engineering and Computer Science
- Interaction with Dr. Sang June Oh, Dean, College of Engineering and Computer Science
- Interaction with graduate students of the Computer Science department
- Lab tour by Mr. Hernan Manabat, Operating Systems Analyst

Program Strengths

The review team found several strengths in the MS program in the Computer Science department. These are briefly described below.

1. Restructured curriculum

The CS department provides a well-defined and robust curriculum aimed at the success of its students. The curriculum is well-aligned with the mission and goals of the department and the University. The department has been actively involved in restructuring the curriculum in recent years. The MS program now mandates that students take courses from multiple domains within computer science, with the aim to expand the breadth of students' coursework. The previous curriculum sometimes resulted in students taking a set of courses within a narrow set of topics. That issue is addressed significantly by the more rigorous and modern updated curriculum.

The program has also added several new courses to the curriculum in recent years to provide a portfolio of technologically relevant courses.

2. Cybersecurity

The CS department has several faculty members that are actively involved in the CSUF ECS Center for Cybersecurity. These include Dr. Mikhail Gofman, Dr. Kevin Wortman, and Dr. Doina Bein. The center is actively involved in collaborative research involving faculty members from multiple colleges. The CS department has been pursuing the hiring of faculty members with expertise in the crucial area of security.

3. Updating of courses and addition of new courses

The program has dynamically updated existing courses as needed to keep them technologically relevant. Several new courses have also been added to the curriculum in recent years. These include

- CPSC - 455 - Web Security
- CPSC - 458 - Malware Analysis
- CPSC - 459 - Blockchain Technologies
- CPSC - 479 - Introduction to High Performance Computing
- CPSC - 483 - Data Mining and Pattern Recognition
- CPSC - 487 - Computational Epidemiology
- CPSC - 515 - Mobile Computing
- CPSC - 552 - Cyber Forensics
- CPSC - 559 - Advanced Blockchain Technologies
- CPSC - 587 - Computer Vision and Deep Learning

4. Hiring of new faculty

Over the past decade, the department has been actively hiring new tenure-track faculty. The hiring of new faculty has contributed to a sustained dynamism within the department and has resulted in the development and addition of several new courses to the curriculum.

5. Personalized attention for students

Students in the program receive support and personalized attention from the department chair, Dr. Chang-Hyun Jo, and from other faculty. Students were also appreciative of the support and guidance given by Dr. Gofman, who is serving as the graduate adviser for the program.

6. Study plan requirement

Students in the program are required to consult their graduate adviser and develop a study plan that goes through a formal approval process before the students can advance to classified graduate standing. The study plan gives students the opportunity to properly plan and take courses that are aligned with their career goals.

7. Rapid increase in demand and high enrollment

Within the last decade, the MS program in computer science has witnessed a rapid increase in demand from applicants. This has resulted in strong enrollment numbers for the program. This has enhanced the positive impact to the economy by the CS department in particular, and the College of ECS and CSUF in general.

8. Plans to address rising enrollment

The computer science department currently has 19 full-time faculty. To meet the requirements of rising enrollment, the program has planned and implemented the hiring of part-time faculty in order to supplement the contributions of full-time faculty. It also plans to hire additional tenure-track faculty to meet the increasing needs of the program.

9. High research and grant activity

The Computer Science department has a faculty body that is actively involved in research. Faculty have been successful in securing grants to support research activity. The addition of new faculty has contributed to an increase in the research capabilities of the department.

10. Strong culture of assessment

The department has developed a strong and consistent culture of assessment. This can be seen in their self-study, as well as in the decisions made in restructuring the curriculum. We commend the department for taking a progressive and evidence-based approach.

11. Pathway for non-CS undergraduates

The program provides a pathway for students without an undergraduate degree to matriculate by taking undergraduate courses. This allows for a larger and more diverse student body.

12. Dedicated data center and staff support.

The department maintains a dedicated data center, supported by Mr. Manabat, which provides students and faculty with the ability to start up servers and conduct network experiments. This local infrastructure is critical in allowing students to conduct independent research.

13. Support from the Dean and Associate Dean

It was clear from our conversations with the Dean and Associate Dean that the department, and the Master's program in particular, are supported by the administration and seen as a core component of the college's strategic plan. We commend this supportive relationship, which will be critical to ensuring the program's continued success.

Program Quality Improvement Areas

The PPR team has suggested the following four program improvements for consideration:

1. Encourage the Thesis Option
2. Strengthen Student Connections to Industry
3. Remap Student Outcomes and Performance Indicators
4. Balance the Required Elective Categories

1. Encourage the Thesis Option

Although both a project option and thesis option are available for students in the MS program, the project option has become more popular. In the Student Group that met the PPR team, none of the students had chosen the thesis option.

One reason the thesis is less popular is that most MS students are bound for industry rather than a PhD program. Students seem to consider the thesis a more difficult option, owing perhaps to their lack of familiarity with academic research. Of the Student Group, only one student had attempted research during their MS program, and had ultimately opted for the project option. Moreover, the CSU Fullerton Graduate Studies Office requires the MS thesis to be submitted in the middle of the CPSC 598 semester (late April or mid November) to allow sufficient time for the review of the formatting and contents. This early deadline further exacerbates the difficulty of the thesis option.

The team recommends that the department encourage the thesis option by adding an additional semester to the thesis sequence. This additional semester would be reclaimed from one of the five free elective courses. Thus, the project option would continue to encompass two semesters (CPSC 589 and CPSC 597) and would continue to require

five free electives. The thesis option would now encompass three semesters (CPSC 589, CPSC 598, and a third thesis course) and would require four free electives.

This additional semester would help popularize the thesis in the following ways:

- Students would now have sufficient time to gain familiarity with the practice of academic research.
- The pressure of the early thesis submission deadline is mitigated, as students would have had an additional semester to prepare their thesis draft.
- Students planning to pursue a thesis are rewarded by taking one less elective course.
- After submission of the thesis, the final weeks of a student's culminating thesis semester could be used to prepare a conference or journal submission with their thesis advisor, which contributes to the advisor's publication record and RTP process.

2. Strengthen Student Connection to Industry

Surveyed MS students in CPSC 597 and 598 have expressed a desire to learn skills that will help them start their career. Survey results indicate that although students find faculty knowledgeable, students demonstrate less confidence when asked if faculty knowledge is up-to-date. The Student Group which met with the team echoed this concern. They mentioned current industry tools and practices which they wish had been introduced as part of the curriculum (e.g. cloud deployment with Terraform).

CSU Fullerton currently offers Curricular Practical Training (CPT), which allows international students on an F-1 Visa to gain work experience and academic credit. The course EGGN 495 provides professional practice toward bachelors degree programs, but is not available for graduate credit. CSU Fullerton also participates in the Google In Residence program, in which experienced software engineers from Google (Googlers) teach introductory programming in the Fall semesters. The college also holds an undergraduate Student Projects Showcase, which includes corporate-sponsored projects; there may be ways to connect Master's students with this, particularly in areas of strength such as cybersecurity.

The team recommends strengthening the MS Computer Science program's connection to industry practices, and encourages the department to consider multiple ways of achieving this. Some possible strategies include a professional practice course for graduate students, and industry-advised thesis and project options.

3. Remap Student Outcomes and Performance Indicators

The team applauds the 2020-21 restructuring of the MS in Computer Science, but notes that the current SO and PI mapping is to courses CPSC 541, 545, 589, and 597. The team notes that not every student takes 541, 545, nor 597.

The team suggests that the SO and PI mapping be revised such that every possible choice of required electives is mapped to the SOs and PIs. Similarly, the team suggests that the mapping be made for both the project and thesis options.

The team anticipates that all performance indicators will eventually be mapped to courses. (In this 2021-22 report, DOCS, COOP, PROC, and CRIT are not mapped.)

The team suggests that student outcomes be tiered by the level of proficiency. For example, an introductory team-project course could **introduce** SO 4, whereas a more advanced project management course could **practice** SO 4, and a capstone team project course would allow SO 4 to be **demonstrated/advanced**.

4. Balance the Required Elective Categories

With the 2020-21 restructuring of the MS in Computer Science, the Required Electives grew from strictly Software Engineering courses (8 possible courses) to include three new categories: Computer Applications (4 courses), Computer Systems (3 courses), and Theoretical Computer Science (1 course). Students may choose at least one course from three of these four categories.

The team recommends bringing balance to the Required Elective categories, which is still heavily skewed toward Software Engineering. The team notes that recently-hired faculty have introduced a number of new courses on timely topics such as blockchain technologies and deep learning. Some of this new curriculum could be leveraged to fill out some of the newer Required Elective categories.

Overall Recommendations and Observations

1. The team agrees with the Long-Term Plans of the Self-Study. Recent updates have improved the quality of the program, and the team agrees with the choice to maintain the current trajectory.
2. Across the entire CSU system, Computer Science B.S. programs have experienced a 20% increase in enrollment over a four-year period (2017-2020, the most recent data). Although the CSU Fullerton MS in Computer Science has maintained a headcount in the low 200s for the past five years, the Long-Term Plan indicates that graduate enrollment can grow at a sustainable rate as long as full-time faculty continue to be hired. Resources are needed to support an increased enrollment as well as increased faculty

count. The team recommends planning carefully to accommodate the projected program growth.

3. After touring the Computer Science building, the performance review team observed that graduate students and their advisors had two spaces in the building at which they could meet and collaborate. One of these rooms, CS-404, is laid out in a cubicle style with couches, giving the feel of a graduate study-room rather than a research space. Another smaller room seems to support some ad-hoc special networking and maker projects. As the department evolves its curriculum and research needs, the team advises careful consideration of space in the Computer Science building in order to support networking projects, IoT projects, embedded/maker-spaces, and virtual/augmented reality applications. As plans for the new Engineering building evolve, we encourage the Dean to keep the space needs of the department in mind.
4. Currently the CSU Fullerton Computer Science Department has two Administrative Support staff members and two Operating Systems Analysts. As the Department continues to grow in faculty, students, and programs, the team recommends that additional administrative support be considered.