

# Strategic Plan

## Donald Bren School of Information and Computer Sciences

Initial Draft: May 18, 2016  
Final Version: December 22, 2016

## Preamble

UCI released a new strategic plan, “Bright Past. Brilliant Future.” in early 2016. The plan is built on four strategic pillars:

- Growth that makes a difference – increasing faculty size and research impact
- First in class – enhancing our educational programs and becoming a “first choice” campus
- Great partners – committing to stronger partnerships with alumni and our community
- New paths for our brilliant future – developing the resource base (funds, staff, facilities) to achieve our goals

Each academic unit has been asked to create/update their own strategic plan with the campus plan in mind.

The ICS process – After consulting with faculty in a schoolwide meeting, meeting with the faculty executive committee, and several discussions with the school’s academic leadership, it was decided to charge a committee with creating an initial draft strategic plan and to then involve the entire faculty in revising that draft. Committee members included: Sharnnia Artis, Kris Bolcer, Dan Gillen, Ed Hand, Alex Ihler, Ramesh Jain, Crista Lopes, Melissa Mazmanian, Jim McKenzie, Gopi Meenakshisundaram, Sharad Mehrotra, Alex Nicolau, Amelia Regan, Hal Stern, Andre van der Hoek. The committee worked with an external facilitator to help us through the process. The committee met first to identify the key issues that we would like to address in the next five years. These are:

- Enhance the school’s reputation
- Develop a greater sense of community
- Improve access and inclusion at all levels (students, faculty, staff)
- Improve the quality and placement of our graduate students; enhance our graduate education programs
- Enhance our undergraduate programs
- Grow the school’s research funding
- Generate resources to become more self-sufficient

For each issue, groups in each academic department were asked to identify department/school strengths and weaknesses (internal factors) related to the issue, opportunities and threats (external to the school) related to the issue, and strategies that we might use to address the issue. At a second meeting these department summaries were reviewed and the ideas consolidated into a single school summary. Subgroups of the committee then wrote up initial drafts of the sections of this report. The draft was circulated to the faculty and discussed at a schoolwide faculty meeting. A revised draft was crafted based on the input received and circulated to faculty and staff. This final document incorporates input received on the revised draft.

## Context and Overall Strategy

UCI's strategic plan "Bright Past. Brilliant Future." charts a course for the university focused on growing the impact of the University and its programs. This document identifies ICS strategic priorities in this context.

The Donald Bren School of Information and Computer Sciences seeks to provide computer science and information technology leadership for the 21<sup>st</sup> century through innovative and broad computing curricula, research and development of state-of-the-art technologies, and collaborations that address key societal issues. As the only computing-focused school in the UC system, and one of only a handful of such schools in an AAU university, ICS brings a unique vision to problem solving in the information age. The pages that follow identify specific areas in which ICS seeks to improve: enhancing our reputation, developing a greater sense of community, improving access and inclusion at all levels, enhancing our graduate and undergraduate educational programs, growing the school's research funding and generating resources to become more self-sufficient. Several strategies are identified for each area. These are listed in order of their priority.

There are two overriding themes that merit attention up front. First, ICS faculty and research are extremely highly regarded. Rankings of computer science programs (which covers the bulk of our faculty) that focus on objective measures of productivity and influence (e.g., the Shanghai Jiao Tong University's Academic Ranking of World Universities, the US News and World Reports Global Rankings, semanticscholar.org produced by the Allen Institute for Artificial Intelligence) place UCI among the top 15-20 computing programs in the United States. Data on faculty productivity from Academic Analytics places each of our departments (computer science, informatics and statistics) in the top 10-15% of their peer groups with the Department of Informatics faculty ranked first among 60+ information science groups. Interestingly, national rankings that are based primarily on reputation (e.g., the traditional US News and World Reports ranking) rank out computing program lower (around 30<sup>th</sup>) than the more objective analyses. This gap is an important issue for ICS and one that we plan to attack in the next several years. Second, ICS has undergone extremely rapid growth in the size of our undergraduate program. Enrollment in ICS majors has increased from 802 in the Fall of 2009 to 2889 in the Fall of 2016. During the same time period (2009-2016) the regular ranks faculty (including LPSOE/LSOE) has increased from 65 to 69 and the lecturer count has increased from 5 to 9. At the start of this period the ratio of our undergraduate population to our teaching faculty count was extremely low compared to the University average; now however we far exceed the campus average with the most recent numbers exceeding 35:1. The growth in undergraduate programs poses a significant challenge for us in attaining the strategic priorities described in subsequent sections.

The sections that follow identify specific strategies that we believe will improve the quality and size of our graduate programs, enhance the diversity of students, faculty and staff, grow our research funding, and generate additional resources. Execution of these strategies will address the critical goal of enhancing our national and international reputation. There is one strategy that cuts across each of these goals. **The size of the ICS faculty needs to grow significantly (by 15-30 faculty) over the next several years.** The new campus budget model has provided

significant resources for the School in response to the increase in workload and these resources are appreciated. They have enabled us to manage the workload for TAs (though our ratio of near 60:1 is high), add some lecturers, and add needed counseling staff. Unfortunately this has not left resources to add to our tenured/tenure-track faculty. It is noteworthy that many peer institutions are making substantial investments in the information and computer sciences at the present time. We believe that these investments reflect the widespread belief that the increase in computer science enrollments is not a short-term or one-time phenomenon. There will likely be ebbs and flows to student enrollments as there have been in the past but these are expected to be relative to the new normal. Support for faculty hiring at other institutions has typically included a combination of philanthropic donations and central campus investment (with the mix varying depending on the institution). As described in the final section of this report, ICS accepts its responsibility for partnering with the campus to generate the resources required to support its initiatives and priorities. It is unlikely however that philanthropy and self-supporting programs alone will be sufficient. Some campus investment is required.

# **Enhancing the Reputation of ICS**

## **Why it is important**

A top reputation is perhaps the most essential characteristic for a School to attain in today's global education market. This is true because a strong reputation is necessary to attract faculty, graduate students, and undergraduate students. It is also key to developing collaborative partnerships and obtaining funding from alumni, philanthropists, industry, and government agencies. An increased national and international reputation would ultimately broaden the School's visibility in intellectual conversation around the globe and as a result should lead to higher rankings by most measures. In attempting to achieve an enhanced reputation, it will be critical for ICS to have a recognized brand that speaks to our mission of providing computer science and information technology leadership for the 21<sup>st</sup> century through innovative and broad computing curricula, research and development of state-of-the-art technologies, and collaborations that address key societal issues.

## **Strengths, weaknesses, opportunities and threats**

The School has multiple strengths and some notable weaknesses in regards to our ability to enhance our overall reputation. Among the many strengths of ICS are the school's top-notch faculty and their innovative science, talented students and robust application pools, and a novel composition of expertise that will be essential in tackling the challenges that society is faced with in the 21<sup>st</sup> century and beyond. Evidence of faculty excellence can be found in the more objective rankings that are being produced (i.e., not rankings based solely on reputational ratings) which typically place our faculty among the top 15-20 computing programs in the United States and the top 30 programs in the world (US News and World Reports Global Rankings; Shanghai's Jiao Tong University's Academic Ranking of World Universities). Data on faculty productivity from Academic Analytics places each of our departments (computer science, informatics and statistics) in the top 10-15% of their peer groups with the Department of Informatics faculty ranked first among 60+ information science groups. The breadth and depth of our faculty have positioned us for leadership in diverse areas like data science, health informatics, human-computer interaction, cyberphysical systems and cybersecurity. Evidence of the quality of our student base is found in their outstanding qualifications (GPAs, standardized test scores) and in the many external fellowships they earn. A final key strength is the unique constellation of programs that make up ICS. ICS has intentionally placed itself far ahead of the curve by incorporating Computer Science, Statistics and Informatics into a single cohesive school. Indeed, one can argue that as a school we cover all of the key elements of modern information and computer sciences.

In addition to the faculty, student and disciplinary strengths of ICS overall, individual departments within the school bring unique strengths to our overarching reputation. Among these, each Department (with varying degrees of success) has built a system to foster and promote each other as colleagues. National and international recognition of individual faculty is critical to enhancing the School's reputation, and without the support of colleagues to nominate and encourage other faculty (especially junior faculty) such individual recognition can be

difficult to achieve. In addition, the departments within ICS generally have a cohesive message as department. However, this could be improved upon by formulating a concise mission statement at the department-level that integrates into the mission statement of the school as a whole. Finally, some individual faculty have been quite successful at developing and maintaining a social media presence. In modern times, many prospective students and faculty hires seek information regarding the strengths of ICS and its departments through online searches and social media connections. In order to grow our reputation overall it will likely be critical to enhance our web presence and expand upon our online presence.

Despite our numerous strengths, ICS does have notable weaknesses that must be overcome in order to further enhance our reputation. Perhaps the most notable among these is a limited overall publicity campaign for the School. This leads to poor communication at the school-, campus-, university-, and community-level. In growing our reputation it will be essential for the School to publicize and communicate the importance of the research produced within ICS. This will ultimately begin to address many of our other weaknesses that include low alumni participation, lack of connection with potential students, and limited exposure to potential donors. Additional weaknesses that must also be addressed include the lack of solid communication infrastructure and the need for faculty buy-in to ensure that each individual faculty member's message is communicated to the broader community. One obstacle to enhancing our communication infrastructure is the heavy demand on faculty time in other areas.

## **Strategies**

- (1) *Build an easily recognizable school brand.*
- (2) *Establish a robust online presence with enhanced communication infrastructure.* The Dean and Director of Communications must be the leaders in this effort.
- (3) *Achieve greater recognition of faculty accomplishments through nominations for national and international awards.* Department Chairs and individual faculty will need to play a key role in achieving this.
- (4) *Lead and participate in large research consortiums and seek large multi-investigator grants.* This is discussed further in the research section of the plan.
- (5) *Increase emphasis on faculty outreach to assist with student and faculty recruitment, and to help publicize our successes to peer programs.*

# Developing a Greater Sense of Community

## Why it is important

Although individuals across the school have developed strong research and interpersonal ties with colleagues in other departments, the faculty as a group tend to be isolated from the research and perspectives developed by their colleagues in the other departments. We sometimes do not know our more recently hired colleagues in other departments and we generally don't know enough about what our colleagues are engaged in at a professional or personal level. A shared orientation of ICS as a community simply does not exist. Traditional academic rewards do not necessarily foster a strong sense of community or encourage faculty to invest in the greater good of the school. However, such a sense of community is critical for: effectively allocating resources; generating an external reputation; developing more relevant, impactful and multi-faceted streams of research; and creating a positive environment that fosters individual productivity, motivation, and innovation. Our vision is to develop within the school an atmosphere of mutual promotion, respect and broad participation.

## Strengths, weaknesses, opportunities and threats

One existing strength in this area is that each individual department does work on developing a sense of community within the department. Regular strategic retreats are one helpful mechanism for achieving this. Further, a substantial number of faculty have developed personal connections with colleagues from other departments and many faculty live in proximity to each other in University Hills. Such connections could be leveraged as a first step in fostering a stronger sense of community.

However, there are numerous barriers in place that get in the way of achieving this goal. First is a sense that we have not put any effort in thinking about strategies for achieving a greater sense of community across the school. Second, the great discrepancy in size between departments leads to a complicated process of resource allocation. Beyond these structural barriers it is also a problem that service is not uniformly appreciated informally or formally across the school; there are still a few too many faculty that try to avoid service. In addition we work in a building with a physical layout that does not support informal interaction. Finally, there is no precedent or infrastructure for: learning about cross-departmental issues; discovering and celebrating the individual success of faculty from different departments; and informally discussing shared personal or research interests.

## Strategies

(1) *Engage substantively to address school issues.* Transfer some departmental service into school-wide service committees that involve creating concrete and actionable solutions to issues across the school.

(2) *Encourage collaborative research visions.* Create a framework for self-aligned visionary groups that come together across departments to brainstorm strategic directions (privacy and

society; big data in health; etc.). Such strategic directions must have the potential to gain real traction from the Dean (FTE's etc).

(3) *Become aware of success and learn to celebrate it.* Develop a more engaged communications team that markets individuals within the school. In other words, if a faculty member achieves some success in his/her field that success should be advertised and celebrated across the school. This will require a much more proactive communications team that is able to gather such success stories and provide a brief but compelling description of the research and the marker of success. It will also require a concerted effort on the part of faculty to communicate their own successes to the communications team.

(4) *Encourage structured informal interaction in small groups.* Large school social events are not well attended and don't foster new forms of interaction. However, small off-site lunches would encourage new ways of getting to know each other across departments. The Dean's office could fund 3-5 person faculty lunch dates. No 'deliverables' are expected from such lunches and assignment of groupings could be random or could depend on characteristics other than home department (e.g. career phase, general research interest, age of children, etc.).

# **Improve Access and Inclusion**

## **Why it is important**

Building a climate of access and inclusion is crucial to the long-term success of the Bren School. First, it has been demonstrated time and again, and in a broad variety of contexts including research and teaching, that teams comprised of diverse membership outperform less diverse teams. Second, as a public university in California that serves a large number of students who are first-generation-to-college in their families, we serve a highly diverse population, and should aspire to serve as role models. Third, inclusive excellence is a top priority on campus, both overall and with respect to ICS.

Overall, then, a key component of our strategic plan is to focus on, promote, and indeed actually establish a climate of inclusive excellence at all levels in the school. This includes faculty, staff, graduate students, undergraduate students, as well as ideally our leadership council and other constituent groups.

## **Strengths, weaknesses, opportunities, threats**

There are a number of campus and school initiatives underway that are strengths for us as we pursue this aim. This includes the campus Office of Inclusive Excellence, which can provide relevant data and information about best practices. The School's equity advisors and DECADE mentors, who are organized and coached through the Office of Inclusive Excellence, serve as a key resource dedicated to ensuring that we pay attention to issues associated with access and inclusion in faculty hiring, graduate student recruitment, and graduate student retention. Within the School, the still relatively new Office of Access and Inclusion has been set up in close collaboration with Engineering to develop important programs to enhance recruitment and retention of students from underrepresented groups in our undergraduate and graduate programs. This includes a highly successful mentoring program through which corporate partners have mentored over 225 students in the past three years

The School has a strong commitment to gender diversity in ICS. Over the past twelve years, ICS has shown proven results in recruiting and retaining women into undergraduate computing programs. The number and percentage of women has steadily increased from 13% in 2004 to 24% in 2015. With respect to gender balance amongst our faculty, ICS has a better track record than most of our peers. That said, our recent track record in faculty hiring is less than stellar.

In terms of weaknesses, ICS has made little progress in recent years in enhancing the ethnic diversity of our graduate student population. While some successes exist in terms of gender diversity (an incoming Ph.D. cohort in CS this year that is 30% female, a gender-balanced Informatics program), ethnic diversity is more elusive. The applicant pool itself continues to lack sufficient numbers of candidates from these underrepresented groups; this is a nationwide trend, though that certainly should not serve as an excuse from trying harder as a school. In addition, at the undergraduate level we continue to see low numbers of students from ethnically underrepresented groups in our more technical (CS, CSE) majors.

Opportunities for enhancing our climate with respect to access and inclusion include the fact that we have many nearby community colleges and universities (i.e., Cal State campuses) with highly diverse populations that we do not sufficiently tap into yet. In addition, system-wide programs encourage partnerships with historical black colleges and universities; we again could be using these programs to our advantage. Further, ICS enjoys a reputation as one of the early, deeply engaged participants in NCWIT, and has clout, knowledge, and relationships as a result that we should be able to leverage. Finally, with all of the attention nationwide in industry regarding the IT profession and issues of gender and diversity, opportunities exist to strike up partnerships and obtain significant financial support for groundbreaking programs.

A key obstacle is the pipeline for prospective faculty hires: the number of highly qualified graduate students and postdoctoral researchers from underrepresented groups in several of our fields is extremely small (particularly so in the more technical fields of ICS) and there is enormous competition when someone does come on the market. This can make it difficult to hire successfully.

## **Strategies**

(1) *Create a strong focus on outreach toward high schools and undergraduate institutions.*

Under the leadership of the Associate Dean for Student Affairs and the Office of Access and Inclusion, this involves building programs that rely on faculty involvement, target recruitment strategically to schools and institutions that serve the underrepresented populations, and focus on building long-term partnership rather than one-off efforts.

(2) *Create programs that build an inclusive culture for students once they join the school.* Led by the Associate Dean for Student Affairs and the Office of Access and Inclusion, this involves new student orientations that focus on engagement (e.g., retreats, boot camps) rather than information provision, expanding our tutoring and mentoring programs significantly, and developing an inclusive climate within the research and educational enterprise through workshops, training, and monitoring.

(3) *Continue to step up our efforts in faculty recruiting and retention.* Led by department chairs, we will seek to address issues related to the limited pipeline by considering hiring postdoctoral fellows to familiarize potential faculty recruits with UCI, creating graduate summer programs, and writing broader advertisements so to attract a larger and more diverse set of applicants.

(4) *Lead by planning and example.* Rather than engaging in individual efforts, we foresee developing a detailed strategic plan, both at the school level and the individual department level, to address the issue comprehensively. By setting goals, measuring progress, and educating the faculty, broader ownership of inclusive excellence will be fostered throughout the school. This cannot be done, however, without the leadership itself setting examples (e.g., creating a more diverse Leadership Council) and actively engaging in the discussion all the time.

# **Improve Graduate Education**

## **Why it is important**

The goal of improving our graduate program is intimately related to all of the other issues addressed in this plan. For example, enhancing our graduate program will contribute to improving our reputation and improving our reputation will help us recruit stronger graduate students. Similarly, improving our research funding will allow us to grow our graduate program and recruit more competitively. Creating an inclusive environment will help attract top Ph.D. students and enhance faculty research.

## **Strengths, weaknesses, opportunities and threats**

A key strength is the quality of our faculty and their research. As described earlier, our graduate programs are ranked extremely high in venues that use more objective bibliometric measures. In addition, many faculty have won significant accolades for their research (e.g., fellowship in professional societies such as the ACM and IEEE, best paper awards). In addition, we believe that our faculty members demonstrate a strong commitment to teaching and instruction through the mentoring of graduate students. Like any strong research program, faculty help students with funding, authoring papers, speaking at academic conferences, internships, and academic placement.

There are a number of weaknesses at present. The gap between what we believe the quality of our programs to be and the perception that the outside world has about our programs is one major weakness. This gap has significant implications for our graduate program. It limits our ability to attract the very best students to apply to us. In addition, among the students who do apply to us, we sometimes lose out to universities with strong general reputations whose programs are not as strong. In addition, the reputation gap can potentially have an impact on the morale of the students and the pride they take in their alma mater. At present, a relatively low number of graduate (and undergraduate) alumni stay connected with the university.

One outside measure of the success of a graduate program is the placement of students in academic positions or jobs at top research laboratories. We have some success in this area but growing the number of such placements would enhance our reputation as a world-class research institution. The reputation gap mentioned above is one factor limiting our success in this area. High salaries in industry are another factor discouraging academic placements and thus work against enhancing our graduate program in this way. Of course there are a number of positive features associated with our students going into industry – it helps us maintain strong relationships with industry and we also receive donations and endowments.

ICS currently has a large cohort of master's degree students. This is a heterogeneous group that includes both research-focused students with an interest in joining a Ph.D. program and professionally-focused students interested in developing the skills needed for industry jobs. The heterogeneity is a challenge for both students and faculty. Correctly organizing our master's programs (including through the use of self-supporting degree programs) will allow for each type of student to receive appropriate training and support.

Another challenge for our graduate program is the uncertain nature of external research funding. While large external grants (e.g., NSF Expeditions in Computing, NSF Science and Technology Centers) can help recruit and retain high quality students and improve our reputation, planning and applying for such grants is time consuming and the probability of success is low. Smaller grants (which have higher success rates) do not provide the year-to-year continuity required to develop and promote students, faculty, and our research over a prolonged period of time. This is discussed further in the next section.

A final challenge worth noting is that recruitment of graduate students from underrepresented groups (females and minority groups) remains a difficult challenge for the school. This is addressed more fully in the previous section.

## **Strategies**

We believe the key to enhancing our graduate programs is to focus on improving recruitment, enhancing the graduate student experience, and investing efforts in keeping our graduates connected with UCI. We have devised several strategies towards achieving these goals:

(1) *Develop relationships with top undergraduate programs internationally to create a pipeline delivering top talent to ICS graduate programs.*

(2) *Incentivize faculty to pursue training grants.* These can be a great opportunity to recruit a stronger pool of students.

(3) *Improve our financial packages to graduate students.* Many of the schools we compete with for students offer significantly stronger financial packages to incoming students. While UCI offers several fellowship opportunities for which we can compete to make our offers more lucrative, we wish to explore additional mechanisms, possibly with help from our industrial partners to make our offers to incoming students more lucrative.

(4) *Improve the graduate student experience at UCI.* The key to our long-term success is to ensure that our graduate students take pride in UCI and, in turn, after graduation, reflect UCI in the most positive way to their employers and to the community. There are several ideas here: increase attention to mentoring and advising; encourage greater recognition of graduate student achievement through department/school awards; create a mechanism to allow graduate students to travel to conferences; create a yearly open house for industry featuring graduate students.

(5) *Energize our alumni.* An engaged alumni can be an integral component of any effort we undertake to improve the perception of UCI to the external community, motivate our current graduate students, or help our graduate students in their career placement. A more robust and engaged alumni network can also play an integral role in promoting UCI, fundraising for the school, and shaping the future of the departments.

# Enhance Undergraduate Education

## Why it is important

The undergraduate mission is core to the functioning of the University. Education around technology is especially important in modern society. During the last 6-8 years, the School of ICS has put significant effort into developing a broad set of undergraduate majors and ensuring that students have the flexibility to easily transfer among them. The changes that we have implemented, along with a huge increase in student demand, have fueled extreme growth in our undergraduate population (from 800 students in 2009-2010 to more than 2300 in 2015-2016). It is important that we continue to work with the campus to determine the right size of the undergraduate population with respect to our faculty size. It is equally important that we continue to capitalize on our unique school structure and continue developing undergraduate programs in novel, high-demand areas. Finally, it is important that we continue to innovate in our pedagogy to ensure that UCI students receive the best educational experience possible.

## Strengths, weaknesses, opportunities and threats

Our undergraduate educational program offers an exceptionally broad set of majors. The school offers majors in computer science, computer game science (established in 2010), data science (established in 2015), informatics, software engineering (established in 2012), business information management (joint with Business, established in 2008), and computer science and engineering (joint with Engineering). Our unique structure, combining statistics, informatics and computer science, enables us to maintain this broad set of programs. The strength of the undergraduate population is another asset. ICS undergraduates typically have among the highest high school GPAs and standardized test scores on campus. Another area of strength of the school is its student affairs office; the office is a highly collegial group that has been able to manage the explosive growth in our programs and maintain sufficient offerings to allow students to graduate on time. Finally, we have dedicated lecturers (both LSOE and Unit 18) that do an outstanding job and assist the tenure-track/tenured faculty in delivering top instruction to our students.

The primary weakness in our program is that resources have not kept pace with demand. The University's new budget model has provided resources that have been used to hire lecturers, teaching assistants and counseling staff. Despite this influx of funds the ratio of students per TA has increased over this time period from approximately 40:1 to approximately 60:1. Class sizes have increased as this is the only way to continue ensuring that students can graduate in a timely manner. To this point we have not seen an increase in the average time to degree, although large classes and limited teaching assistant resources do impact the quality of our education.

## Strategies

- (1) *Work with the campus to identify a sustainable student population size.* Demand for our undergraduate programs is large and growing at the current time. All qualified candidates can thus not be admitted. At the present time enrollment is often driven by outside considerations; the appropriate size of an entering class needs to be determined in concert

with the campus administration. It is important that campus resource commitments to the school are appropriate to the level of enrollment.

- (2) *Increase the number of Lecturers with (Potential) Security of Employment to roughly 10% of the faculty.* One obvious benefit of such faculty is their ability to help teach our large undergraduate population. The core motivation however is to create a group of faculty who have outstanding knowledge of their fields, a focus on education and the institutional commitment that will allow them to innovate and lead our pedagogical efforts. Achieving this strategy depends of course on having sufficient faculty growth.
- (3) *Continue to innovate in the undergraduate curriculum.* ICS's status as a school of computing provides us with the opportunity to develop novel programs that will attract students. At present there is still a plan to develop an undergraduate statistics major. No other undergraduate programs are planned at present but it is important that faculty continue to think about opportunities.

# Grow Research Funding

## Why it is important

Research and teaching are the two main missions of a research university. What's more, at a research university of global prominence such as UCI, research is arguably the more critical mission in as much as it informs, and is increasingly responsible for supporting/subsidizing, the teaching infrastructure. Indeed, growing research funding is likely to directly contribute to achieving success in the other areas identified in the plan, specifically enhancing our reputation and enabling us to recruit top graduate students. In the information and computer sciences, where the opportunities for growth are virtually boundless (in terms of both demand from students at all levels – B.S., M.S., Ph.D. – and opportunities for funded research) the need to increase our research footprint are obvious and self-explanatory.

## Strengths, Weaknesses, Opportunities and Threats

The information and computer sciences are at the heart of, or can greatly contribute/enhance, virtually any human endeavor today and in the foreseeable future. UCI is particularly well placed in this regard, as our school is unusually broad in its interests and expertise. In many of the hottest areas in the field, such as human-computer interaction, cyberphysical systems, data science, and health applications, our school has exceptional promise. We already have some of the pioneers and leaders in these fields “under one roof” and thus by strengthening these areas we are exceptionally well positioned to contribute and lead major research initiatives both within the main areas of ICS itself, and across disciplines including those in the Arts, Social Sciences, Medicine, Engineering, Physical Sciences, and Life Sciences. The School's computing support staff are another strength. They run the 2<sup>nd</sup> largest data center on campus and have considerable expertise to support faculty research efforts.

Our departments/school already has a very strong research presence both nationally and internationally as described elsewhere in this plan. A weakness however is the nature of our current research awards portfolio. ICS faculty are able to attract substantial research funding from a variety of highly competitive venues, yet these grants are typically small, in the range of \$50,000/year to \$300,000/year range, with larger grants being the exception more than the rule. In contrast, typical top computer science programs attract consistent and multiple large group grants. Clearly, if UCI is to dramatically grow its research reputation, it needs to be able to attract large grants and host national level projects consistently and in much larger quantity than it now does.

A challenge in the area of research funding is our growing student population. Our undergraduate population which sat around 800 students in the Fall of 2009 is poised to climb well above 2500 in the Fall of 2016. Our master's program enrollments have also grown substantially during this period while the Ph.D. population has remained relatively constant. We don't believe it is a coincidence that new NSF awards to ICS faculty have dropped during this period of extreme student population growth. The faculty size needs to grow to meet the demands of our increasing student population. A final noteworthy challenge is that generating major ICS research projects requires dramatic staff, space and

equipment support. While faculty at UCI have occasionally participated or even led such efforts, major grants involving partnerships with other institutions are the exception rather than the rule at UCI. Pulling together such proposals requires considerable effort and support from within ICS but also from the campus. UCI's strategic plan has aggressive targets for research growth and has identified improving the research infrastructure as a key component. ICS needs to enhance the incentives offered for faculty to pursue large grants and we need to enhance the support that is provided for faculty who are willing to take on this challenge.

## **Strategies**

ICS has enormous potential for research growth, and enormous potential impact on society and science for the foreseeable future. To achieve this potential in the UCI context, several important things need to happen:

- (1) *Campus level investment to increase the size of the ICS faculty.* The student-faculty ratio in ICS is quite high. Investment from the central campus seems merited. Indeed, to achieve the ratios observed in other units on campus (and across the nation), ICS would need to grow by 15-30 faculty in the near future. The campus administration should consider all opportunities to grow the faculty.
- (2) *Create school-level programs to incentivize and support faculty efforts for large grants.* The school can provide support for increased research funding in a number of ways. For one thing, the school can and should provide incentives for faculty that pursue large multi-investigator grants. In addition, qualified staff support, especially for the management of large projects is also a pre-requisite for such projects. For software system oriented projects it is important to have software development professionals to assist research.
- (3) *Develop opportunities for faculty interaction within departments, between departments, across schools at UCI and across universities.* Our faculty are by and large open to and even eager for the cooperation and extensive interaction required in large research projects with many PIs and tens of participants. Nevertheless, inertia leads people to concentrate in their own particular niche area as the most efficient way of producing research results. To combat this, we need to create opportunities, in a sustained manner, for interactions. Such interactions may consist of informal gatherings within and across departments, hosted meetings with faculty from others schools to encourage partnerships, events encouraging partnerships with faculty at neighboring institutions, and faculty-industry forums.

## **Generate Resources to Become More Self-Sufficient**

### **Why it is important**

The financial model of the campus has changed in recent years with the expectation that schools pursue and self-fund initiatives that require resources beyond what the current budget provides. It is clear that state funding will not allow the campus to allocate sufficient resources to keep up with the growth of the school and to fund the initiatives that drive our strategic mission. Beyond traditional grant funding, we know that additional resource opportunities exist through partnerships with industry, philanthropy, self-supporting degree programs, and short courses / certificate programs. Generating these additional resources will not only allow us to be more self-sufficient, it will help to achieve the priorities identified in the strategic plan by implementing the identified strategies.

### **Strengths, weaknesses, opportunities, threats**

ICS has numerous strengths that position us well to generate more resources. The school possesses high quality faculty, many of whom collaborate well both internally and externally. Coupled with very compelling stories in our field that are socially relevant, faculty have the ability to connect in meaningful ways with potential donors. One such example is the interesting autism research conducted by Professor Gillian Hayes that piqued the interest of donors and ultimately led to the Robert A. and Barbara L. Kleist Chair in Informatics.

Another strength of the school is that we are well situated for the development of professional degree programs and for generating resources through other activities. There is a high demand for short, professional MS degrees in computing and information technology as well as potential demand for summer programs and certificates. We have successfully developed self-supporting programs in-house, and an inherent advantage of the field is that we are able to uniquely join with other disciplines to create joint programs. We currently have two programs approved (MHCID and MCS) and one under development (Software Engineering). The importance of the information and computer sciences across virtually all disciplines of scientific research provides other opportunities for generating resources. For example, the Center for Statistical Consulting (CSC) has the potential to generate income through consulting activity and training courses. The Data Science Initiative and the developing interdisciplinary institute in cybersecurity may also have opportunities to create non-traditional funding sources. In addition, ICS has parlayed its success in student projects into a “Corporate Partners” program. The corporate partners program has broadened the exposure of our academic programs and helped to develop a more robust relationship with multiple industries.

Helping set the stage for future support, the School has embarked upon a strategy to increase alumni engagement over the past couple of years that is already reaping benefits. Attendance at alumni events is growing and our annual fund support has grown substantially in the past two years. While the level of support is still relatively small, it should continue growing over time

and bodes well for funding from our maturing alumni base. Support from foundations is another possible opportunity. Unfortunately, support for reaching out to foundations has traditionally been centrally located at the University level and focused on other Schools. While changing, we still have a long way to go in this area.

The school's primary weakness in generating more resources is the lack of time and incentive to do so. Due to the school's surging student population, faculty are facing larger classes and are teaching these larger classes with less TA support per student than in the past. Combined with very limited support for large initiatives and the perception that there are no real incentives to take on the extra work, some faculty resist carving out the time necessary to build the relationships necessary to fundraise or create new programs. The new self-supporting degree programs have the potential to help address some of these concerns through the provision of resources and as examples of what can be achieved.

Bureaucratic red tape is one external obstacle faced by the school. One example of this is the two-year approval process required to launch a self-supporting program. Additional obstacles include the need for more staff to support new programs and initiatives, a lack of connection with the development team, and a small and young alumni base.

## **Strategies**

(1) *Self-supporting degree programs.* Continue to develop self-supporting programs where there are opportunities. Work with the campus to improve, to the extent possible, the self-supporting program approval process.

(2) *Partnerships with industry.* Connect faculty with foundations and industry to pursue funding opportunities. This should involve the Director of Corporate Relations and the Director of Collaborative Research. This may include industry funding through participation in international offsets arrangements. Partnership with UCI Applied Innovation can play a critical role in forming such partnerships.

(3) *Fundraising and alumni relations.* Continue to build and connect with the alumni base. Improve our ability to put compelling stories into the hands of donors.

(4) *Recharge operations.* Explore revenue options for the Center for Statistical Consulting. Consider other areas of expertise in which services that might be provided (e.g. medical informatics, data science).