Description of Institutional Environment and Commitment to Training

Graduate Group in Computer Science: I will conduct this research as a PhD student in the Graduate Group in Computer Science (GGCS) at University California Davis (UCD). UCD is an institution with world class facilities for both computational and medical research. In the GGCS, graduate level machine learning (ML) courses are offered at least once a year and more specialized research courses in ML can be taken when available. The GGCS has faculty with diverse interests and has one expert on deep learning, Yong-Jae Lee, who is also a member of my PhD committee. I also have a collaborative relationship with Dr. Chen-Nee Chuah of the Electrical and Computer Engineering Department. Dr. Chuah has been instrumental in helping me hone my skills in ML and we plan to continue to work together in the future to investigate how machine learning and deep learning can be used to generate synthetic datasets for medical applications that are useful for sharing with the research community as well as for training the medical workforce when real life data is hard to obtain. Other ML practitioners/researchers are also employed by GGCS including: Dr. Ian Davidson PhD who specializes in algorithm design. Dr. Cho-Jui Hseih PhD who specializes in big data optimization. Dr. Ilias Tagkopoulos PhD who focuses on bioinformatics, and Dr. Zhou Yu PhD who is an expert in machine speech recognition. I plan to utilize the help of these professors should a problem I encounter touch upon their expertise. *The GGCS and its faculty offer me excellent resources to build my skillset in ML so I can translate it to use in healthcare data analytics.*

The GGCS has a long tradition of collaborative relationships. Before moving into my current work with Dr. Adams I collaborated with other members of the GGCS, including with Dr. Cynthia Rubio-Gonzalez in software engineering and with Dr. Matthew Bishop in security research. Dr. Chuah and I continue an active collaboration on that focuses on analyses of PaO2:FiO2 and patient ventilator asynchrony (PVA) data to determine if PVA plays a role in harming patient oxygenation. Furthermore, Dr. Chuah and I continue to collaborate in building a mobile application that can automatically display ventilator waveform data (VWD) and alert clinicians to the presence of PVA. The GGCS also attracts nationally renowned scholars to share their research with students. Colloquiums given by visiting scholars are common and occur approximately twice a month. *The GGCS faculty have been very open to collaboration and will continue to be an asset as I improve my skillset as a computer scientist and informaticist.*

University California Davis Health System and Medical Center: UC Davis Health is comprised of the School of Medicine, Betty Irene Moore School of Medicine, UC Davis Medical Center, and the Comprehensive Cancer Center - and is nationally recognized and excels at translating scientific discoveries and new technologies into improved patient care and community-wide health. UC Davis Health has 1,506 faculty, 872 residents, 800 students, and 10,155 staff. More than 1,100 basic science, translational, and clinical research studies are currently underway in the School of Medicine facilities in Davis and at the Medical Center in Sacramento, funded by federal, state, foundation, and pharmaceutical/biotechnology sources. Research strengths include: cancer, cardiovascular health, epidemiology, evidence-based clinical care, health disparities, health policy, human molecular genetics, infectious disease, injury and healing, lifespan health, neurosciences, and regenerative medicine. The UC Davis School of Medicine also collaborates with several affiliated research institutions, such as Shriners Hospital for Children Northern California, Veterans Affairs Northern California Health Care System, USDA Western Human Nutrition Research Center, and Lawrence Livermore National Laboratory.

For my studies, the medical center is a rich and supportive academic training and research center. Access to patients and active clinical environments will be through the sponsorship of Dr. Adams and his clinical appointments within the medical center. The prospective cohort of patients on whom we will evaluate algorithms to measure respiratory compliance and airway resistance are directly available through the research focus of Dr. Adams and the Critical Care Informatics Lab (CCIL), and the commitment to clinical care and research development of the Division of Pulmonary and Critical Care Medicine which manages six distinct intensive care units within the hospital. Closely aligned with these operational hospital environments is the Center for Virtual Care (CVC), a unique simulation and training resource where technical and clinical workflow evaluation can be conducted in mirror environments to the hospital. Access to clinical instrumentation including model lungs, advanced patient simulators and clinical data acquisition and management tools provide an unparalleled and unique opportunity for iteration and evaluation of the full clinical workflow for my research plan.

The commitment of these clinical units, access to the training and simulation environments, and support from both academic and clinical researchers across UC Davis Health make this a rich and supportive environment for my research. I have several ongoing collaborations that bridge these domains which demonstrate the capabilities; I collaborate with Dr. Brooks Kuhn to develop data analysis and annotation techniques that may improve standards of care for patients with chronic obstructive pulmonary disease (COPD). With Dr. Michael Johnson in Emergency Medicine I am developing analytic supporting tools for automated and semi-automated devices for use in battlefield or critical care environments,

which has led to a patent filed for the integrating spirometry and PVA detection. At the department level, events such as the UC Davis Department of Internal Medicines annual “Lung Day" has provided me with the ability to network and study as a peer with clinical and translational investigators as well as industry professionals. *The institutional facilities and environment at UCD Medical Center offer an excellent environment to pursue my research, build collaborative relationships, and grow into an independent researcher.*

Educational Information

PhD Program Requirements and Timeline: The GGCS requires that all PhD students take a minimum of 10 courses (total of 30 Credits). Doctoral students must take one course from each of the four core areas: Architecture, Systems, Theory, and Applications. The department requires that all graduate work meet a grade of at least an A- in each class representing a core competency. Attaining a grade of B or higher is required in all other classes.

Advancement to candidacy is achieved once the student has completed all course requirements, has prepared a comprehensive thesis proposal and has passed their qualifying examination. The qualifying examination is a significant milestone used to validate the candidate’s readiness to pursue their proposed dissertation research. It consists of a formal oral examination by at least 5 faculty members, including at least 3 members of GGCS. Passing the qualifying examination allows a student to move the independent phase of their studies and conduct their own work.

Once a student advances to candidacy, weekly progress reports are required by the Thesis Advisor to assess progress of research and assist the candidate with difficulties. The graduate group also requires that at least 1 quarter of teaching work be conducted before graduation. At the completion of their research a candidate files their PhD dissertation with the university and conducts an exit seminar where the candidate presents their research to the UC Davis academic community. Typically GGCS students take 4-5 years to complete their PhD.

Candidate’s Current Position: I am currently enrolled as a PhD student in GGCS at UC Davis. My PhD committee chairperson is Dr. Chen-Nee Chuah. I have already spent 2 years at UC Davis to obtain my Master’s in Computer Science and plan to spend an additional 3 years before termination of my PhD. I will take an additional course in order to fulfill the Theory course requirements for GGCS. I will finish this course in March and will then take the qualifying examination in either April or May of 2018. After this is completed, I anticipate I will finish my dissertation in December of 2020.

This information has been approved of by Dr. Kwan Liu Ma, Professor of Computer Science, Chair of Graduate Group in Computer Science.