

DATE: May 11, 2017

SUBJECT: New Academic Program
University of Tennessee-Knoxville
Data Science and Engineering, PhD
(CIP 30.0601-- Systems Science and Theory)

ACTION RECOMMENDED: Approval

PROGRAM DESCRIPTION

The proposed Data Science and Engineering PhD program at UT Knoxville will combine training in computer science relative to data bases and analytics algorithms coupled with the areas of strength at the Oak Ridge National Laboratory (ORNL). In addition to faculty from UTK and ORNL, top researchers from University of Tennessee Health Science Center and University of Tennessee Chattanooga will also support the interdisciplinary program. The proposed PhD program will focus on seven key research areas that depend critically on the ability to analyze massive data: health and biological sciences, advanced manufacturing, materials science, environmental and climate science, transportation science, national security, and urban systems science. These areas of strength and investment are all current priorities for the State of Tennessee. The program will train students from the world's leading undergraduate institutions to apply data science and big data technology to solve critical problems in science, engineering, and society.

Modeled after the successful UTK/ORNL interdisciplinary PhD in Energy Science and Engineering, the proposed Data Science and Engineering (DSE) PhD program will also be administered by the Bredesen Center for Interdisciplinary Research and Graduate Education. Foremost among the goals of the proposed program is to strengthen the competitive position of the Tennessee state economy. Data science is firmly established and growing in importance at leading firms such as HCA Healthcare, FedEx, Eastman Chemical, Blue Cross and Blue Shield, and numerous mid-size firms and startups. The DSE degree program presents profound opportunities for economic development in the State of Tennessee. The seven initial research areas of focus summarized above all have great importance, not only to the country, but even more to the state.

GOVERNING BOARD APPROVAL

The proposed Data Science and Engineering PhD program was approved by the UT Board of Trustees on March 29, 2017.

PROPOSED IMPLEMENTATION DATE

Fall 2017

RELEVANCE TO INSTITUTIONAL MISSION AND STRATEGIC PLAN

The primary mission of the University of Tennessee, Knoxville is to move forward the frontiers of human knowledge and enrich and elevate the citizens of the state of Tennessee, the nation, and the world. In parallel, the nearby Oak Ridge National Laboratory seeks to conduct basic and applied research that strengthens the nation's leadership in key areas of science; increases the availability of clean, abundant energy; protects the environment; and contributes to national security. This proposed PhD program offers a collaboration of UT institutions and ORNL to create a rich and stable supply of cutting-edge experts that can help meet the needs of the State of Tennessee and the nation in vital data-centric disciplines. Faculty and programs at the UT Health Sciences Center and UT Chattanooga will contribute to this new degree program.

At the state level, the proposed DSE program directly addresses the Tennessee Higher Education Commission Master Plan for 2015-2025, which calls for higher education to address the state's economic development workforce development and research needs and increase the efficiency of degree production. Even more directly, this program provides significant leverage toward meeting UTK's Vol Vision 2020 goal by strengthening overall graduate education, generate more doctorates and attracting more of the best and brightest students from across the country and around the world, a key aspect of the drive towards Top 25 status among U.S. state-supported universities.

CURRICULUM

The proposed 72 semester credit hour (36 semester credit hours post masters) interdisciplinary Data Science and Engineering doctoral program will combine training in computer science relative to data bases and analytics algorithms coupled to the many big data challenges in specific domain areas of strength at ORNL and UT institutions. The students will actively engage in research throughout the program culminating with qualifying and comprehensive examinations and the dissertation research topic.

PROGRAM PRODUCTIVITY

Enrollment projections are based on the selectivity of the program. Students will be recruited nationally from the top institutions to participate.

	2017	2018	2019	2020	2021	2022	2023
Enrollment	15	20	25	25	25	25	25
Graduates	--	--	--	--	10	15	15

PROGRAM DUPLICATION

No other public or private college or University in Tennessee offers a similar degree programs. There are a few such data science and engineering programs at other

universities, and funds have been allocated for other universities to initiate such a degree program.

EXTERNAL JUDGEMENT

External review of the program was conducted during an institutional site visit on March 1-2, 2017. Mr. Ian Foster, Senior Scientist in Mathematics and Computer Science at the Argonne National Laboratory and Dr. Timothy Persons, Chief Scientist with the United States Government Accountability Office served as the external reviewers. They stated in their written report that “The emergent and emerging data-driven industrial revolution is transforming the types of jobs that are available and the specific job skills required to succeed in the coming decades...We are pleased to unequivocally recommend approval of the proposed program since we believe it we be beneficially transformative endeavor to the students, research institutes, industry, and people of Tennessee and United States alike.”

STUDENT DEMAND

It is anticipated that the enrollments would be 15-25 full time students each year. With industry demand along with the elite nature of the proposed Data Science and Engineering PhD program, UTK anticipates an attrition of as many as three students annually. All of these students over the average of five years will be supported on the \$30K stipend.

OPPORTUNITIES FOR GRADUATES OF THE PROGRAM

The State of Tennessee has projected that the largest growth in jobs in the next 8 – 10 years will be in the fields of computing, mathematics, engineering, and healthcare – all of which are essential to the economic health of the state and region. It is projected that graduates from the DSE PhD program will be employed by leading firms in Tennessee and across the nation. They will contribute to research teams in industry, government, retail, healthcare, energy, manufacturing, aeronautics, and transportation positions. The core skills of these graduates will enable them to become leaders in these industries. Many of these graduates will make their own way as innovators and entrepreneurs, creating employment opportunities for others as they build new visions and applications of data science.

INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM

Given UTK’s status as the state’s flagship institution, the strength of relationship with Oak Ridge, its demonstrated success with the UTK/ORNL interdisciplinary PhD in Energy Science and Engineering, and the funding support requested through Governor Haslam, UT Knoxville is well equipped to deliver this DSE PhD program.

New costs generated by the proposed program will be covered by three sources of income: ORNL or UT research groups will share the full cost of the graduate student once the student joins that group for dissertation research - stipend, tuition, and insurance, and then cover the full cost when the student has finished two years of coursework. Secondly,

UTK will provide a Research Incentive Fund proportional to the volume of grants and contracts that come to the university by virtue of Bredesen Center-related activity, e.g., ORNL support of DSE graduate students - the same model as for the ESE doctoral program within the Bredesen Center. Thirdly, Governor Haslam has requested the Tennessee Legislature to appropriate \$6M of one-time funds for support of the new DSE doctoral program.

Extensive supporting resources are already available, including participating faculty, laboratory space, library resources, and the existing infrastructure of the Bredesen Center. The largest expense for the proposed program will be graduate student stipend, tuition and insurance. Two FTE support staff will be needed to assist with business operations of the Bredesen Center and graduate student affairs.

ASSESSMENT AND POST-APPROVAL MONITORING

An annual performance review of the proposed program will be conducted for the first seven years following program approval. The review will be based on benchmarks established in the approved proposal. At the end of this period, the campus, institutional governing board, and Commission staff will perform a summative evaluation. The benchmarks include, but are not limited to, enrollment and graduation, program cost, progress toward accreditation, and other metrics set by the institution and agreed upon by governing board and Commission staff. If benchmarks are not met during the monitoring period, the Commission may recommend that the institutional governing board terminate the program. If additional time is needed and requested by the institutional governing board, the Commission may choose to extend the monitoring period.