Richard B. Brown
Dean of Engineering
1692 Warnock Engineering Building
72 S. Central Campus Drive
Salt Lake City, Utah 84112
PH: (801) 585-7498   FAX: (801) 581-8692
brown@utah.edu
http://www.coe.utah.edu/~brown

July 25, 2018

To Whom it may concern:

I enthusiastically support the BS degree in Data Science that is being proposed by SoC Associate Professor Jeff Phillips and the School of Computing.

Data Science is an area that has seen extreme growth in use and importance in the last decade, and Jeff and his fellow proposers have been the leaders on campus in building our capabilities in this area. Their research has developed new techniques for analyzing and managing large complex data, and also explaining why these techniques work. As a group, they have also been examples of interdisciplinary collaboration with data domain experts across the sciences, health care, psychology, and other disciplines within engineering. The proposed degree will extend the close collaboration in this area between the School of Computing and the Math Department, that began with the transformative excellence program hires in Statistics, and continued with the interdisciplinary Center for Data Science that is being formed.

As Data Science has grown in importance, student interest has grown. We established a Data Science track in our masters degree several years ago, and we offer some of these courses remotely to Adobe and other companies, but we believe it would be most appropriate to establish a separate degree for the undergraduate students, both to attract the best students and to optimize their marketability as graduates. Other universities, such as Ohio State, Penn State, UC Irvine and UC Berkeley are starting data science undergraduate degrees, so it appears that a national movement in this direction has begun. Student interest at the U has been documented through the large attendance at public data science events, involvementn in a data science club that has been formed here, large enrollments in the core data science courses, and the appearance of bachelor of university studies degrees in which students define what is really a data science curriculum.

Industry has an insatiable appetite for employees who have data science expertise. I have had many conversations with representataives of local companies who are frustrated because they are not able to find the employees they need in this specialty. A focus group of industry representatives was held in August of 2017, that affirmed the need for graduates with this background and supported establishment of the degree. A data science degree would produce more of these graduates, and would make it clear to employers that the University of Utah is the place to find them.

I am not one who believes in establishing boutique degrees, but data science is one of the two hottest areas in computer science for the next decade, and I believe the proposed degree will be helpful in raising the profile of the University of Utah in this important area. Fortunately, the degree is well-aligned with our faculty strength and current course offering, so to start offering the degree, we need to develop only one new course. Our overall reputation will benefit as the U becomes a data science leader in the Mountain West and nationally. The degree will help us recruit top faculty and students who are interested in this area. It will also raise awareness of our data science strengths around the University and the State, and I expect this will lead to an increase in impactful interdisciplinary research and in external funding.

In summary, I whole-heartedly support the establishment of a data science undergraduate degree through the School of Computing. Please feel free to contact me with any additional questions.

Sincerely,

Richard B. Brown
Dean

September 20, 2018

To Whom It May Concern.

I am writing in strong support of the creation of the new B.S. in Data Science, proposed by the School of Computing and led by Associate Professor Jeff Phillips.

Data science is an emerging discipline that lies in the intersection of applied mathematics and statistics, computing, and various data-rich scientific disciplines. At the same time, it is distinct from these fields and with its own character, as well as pre-requisites. Moreover, data science requires skill sets that are playing an increasingly-essential role in a variety of data domains and industrial settings. Because of this, now is an excellent time to focus training Utah students in this particular area of activity.
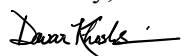
Fortunately, the University of Utah already has excellent infrastructure for training students in these disciplines, as there already are various graduate programs in the Department of Mathematics, in the School of Computing, and in other more data-driven domains that are preparing students to excel in the general area of data science. However, I am not aware of an existing (and compelling) undergraduate program in data science at the University of Utah, and am convinced that the proposed program provides an excellent opportunity for offering a top-level B.S. degree in data science in Utah. The proposed curriculum is well thought out, and compares well to several other national programs in this field.

The Department of Mathematics has been in close communication with Dr. Phillips and the School of Computing as they have put together their plans for this degree. We have productively discussed how best to use and adapt courses from the Department of Mathematics in this major. For instance, the Department of Mathematics will teach basic required courses in calculus, linear algebra, probability, and statistics, as well as offer some advanced electives.

Data Science is an important emerging discipline, and it is essential that the University of Utah invest in this area as soon as possible. We are well positioned to be a regional leader, and the proposed degree program is going to be one of the important next steps towards our goal of establishing regional leadership. In addition to its important educational goals, the proposed B.S. will help with faculty hiring and attracting stronger, and more diverse, students.

In summary, the SoC proposal for the new B.S. in data science is an excellent one, and has my strongest support.

Sincerely,

Davar Khoshnevisan
Professor and Chair

August 15, 2018

Jeff M. Phillips, Director, Data Management and Analysis Track
Associate Professor
School of Computing University of Utah University of Utah
50 Central Campus Drive, Room 3190
Salt Lake City, UT 84112

Dear Professor Phillips,

The University of Utah Marriot Library appreciates the request to comment on our ability to support a Bachelor of Science in Data Science.

The Library has been supporting students in the School of Computing for many years and has extensive holdings to support undergraduate study in data science, including monographs, databases, and journals. Because the curriculum supporting the program will largely be based on existing courses, our current collections should already have sufficient size and depth to satisfy the needs of most students and faculty.

The Library regularly acquires scholarly books in computer science, mathematics, statistics and other related disciplines. We are able to purchase specific books upon request, and we encourage faculty and students to work with librarians to obtain any needed books.

The Library maintains subscriptions to core journals covering data science, including *Artificial Intelligence, Big Data Research, Journal of Big Data, Sigkdd Explorations, ACM Transactions on Knowledge Discovery in Data, Data Science Journal, Statistical Analysis and Data Mining, IEEE Transactions on Knowledge and Data Engineering*, and the *Journal of Data Science.* The Library also collects all published IEEE and ACM conference literature.

We subscribe to many databases that will support this program, such as the *Web of Science, Scopus, INSPEC,* the IEEE's *Xplore Digital Library, MathSciNet, Library, Information Science & Technology Abstracts,* the *Computer Database,* ACM's *Computing Reviews, Proquest Dissertations & Theses Global, Academic Search Ultimate*, and *Computer Source*.

As the scholarly communication landscape continues to evolve, new options for information access often exist beyond traditional print book purchases and conventional subscriptions. We would be pleased to work with faculty to identify and evaluate the most efficient and effective means available to provide the information needed by faculty and students associated with data science.

Student difficulties in locating materials often stem not from collection weaknesses, but from the complexities of using a large research library. Professional library staff offer training workshops, online tutorials, and one-on-one consultations to University of Utah students and faculty. Similarly, we offer class presentations by library specialists who will suggest appropriate search strategies and help students locate relevant resources for their courses and independent research projects.

The Marriott Library is looking forward to engagement with the faculty and students in this new program.

Sincerely,

Mark England

Mark England
Head, Collection Management
J. Willard Marriott Library

September 20, 2018

Ross Whitaker
Director, School of Computing
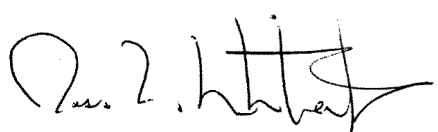Salt Lake City, UT 84112

To Whom it May Concern,

I am writing to express my support and to request your support for the proposed Bachelor's of Science in *Data Science*.   This degree has the full support of the School of Computing faculty and the leadership of the School. The proposed degree fills a very important need, and the curriculum has been developed by experts in the field over several years, with input from faculty in multiple departments as well as perspective employers.

In the development of this proposal the School has consulted with colleagues in the College of Science, especially the Department of Mathematics, and we believe we have support for this proposal across colleges.

The proposed degree requires very little in the way of new classes, and the School is prepared to teach these classes from the current resources and currently planned growth. We do anticipate that this degree could be very popular, and in the long run we anticipate that its growth will be commensurate with the overall resources that the School and the University are able to allocate.

I hope you see fit to support this proposal–we believe this degree will be very important to the University and the State of Utah.

Sincerely,

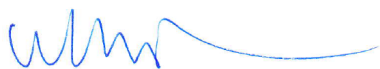Ross Whitaker
Director, School of Computing

November 16, 2018

I am writing to provide my strong support for the creation of a Bachelor of Science in Data Science as proposed by Associate Professor Jeff Phillips. Data Science is a fast growing area that significantly impacts all aspects of life, including business, finance, healthcare, public health, etc. To be leaders in these fields, the University of Utah must train more students in data science. There are shortages of data scientists across the nation, and now is the time to increase our capacity to train students with a BS in data science.

Our department offers MS and PhD degrees in Biomedical Informatics, and we have a new data science track. However, most students enrolling in our graduate programs do not have sufficient background in data science. We, therefore, spend a lot of our curriculum attempting to give them the foundational knowledge and skills they need in data science before we can teach them how to apply the skills in health care. Having a BS in data science would be a great boon to our department and would potentially provide more qualified applicants to our graduate program.

Please do not hesitate to contact me if there are questions or if further information is needed.

Sincerely,

Wendy W. Chapman, PhD
Jon M. Huntsman Presidential Endowed Chair
Professor and Chair
Department of Biomedical Informatics

Wendy.chapman@utah.edu

University of Utah

Undergraduate Council

Sterling Sill Center

195 South Central Campus Dr.

Salt Lake City, Utah 84112

November 19th, 2018

Subject: Letter of Support for Bachelor of Science in Data Science

To University of Utah Undergraduate Council:

I am writing to offer my support for the proposed Bachelor of Science in Data Science. The David Eccles School of Business looks forward to partnering with the School of Computing to offer electives in the future.

Sincerely,

Taylor Randall, PhD
Dean

Proposed DATA SCIENCE B.S. Degree Requirements*

June 21, 2018

Premajor Requirements

C- or better in each course, and a minimum 3.0 average GPA (overall and within pre-major courses) required to apply for full major status.

1. CS 1030, Foundations of CS[1] ⎯⎯⎯(3)
2. CS 1410, Object-Orient. Prog. ⎯⎯⎯(4)
3. CS 2420, Algorithms/Data Struct. ⎯⎯⎯(4)
4. Math 1310, Engineering Calculus I (QR) ⎯⎯(4)
5. Math 1320, Engineering Calculus II (QR) ⎯⎯(4)

General Ed Requirements

Honors options also accepted for WR2, CW, and AI requirements.

1. Wrtg 2010, Intermediate Writing (WR2) ⎯⎯(3)
2. Wrtg 3012 or 3014 or 3015 (CW) ⎯⎯⎯(3)
3. American Institutions (AI) ⎯⎯⎯(3)

Specific Ethics of Data course

4. CS 4962, Ethics and Data Science (BF?) ⎯⎯(3)

FIVE more Intellectual Exploration (IE) courses required. TWO must be upper division (3000-level or above), ONE must satisfy the Diversity requirement and ONE must satisfy the International requirement.

5. Fine Arts (FF): ⎯⎯⎯(3)
6. Fine Arts (FF): ⎯⎯⎯(3)

7. Humanities (HF): ⎯⎯⎯(3)
8. Humanities (HF): ⎯⎯⎯(3)

9. Social/Behavioral Science (BF): ⎯⎯⎯(3)

Analytical Foundations

C- or better required in all math foundations.

1. CS 2100, Discrete Structures ⎯⎯⎯(3)
2. Math 2270, Linear Algebra ⎯⎯⎯(4)
3. Math 3070, Applied Statistics 1 ⎯⎯⎯(4)
   or CS 3130/ECE 3530, Eng. Prob Stats ⎯⎯(3)
4. Math 3080, Applied Statistics 2 ⎯⎯⎯(4)
5. CS 4964, Foundations of Data Analysis ⎯⎯(3)

Computing Foundations

C- or better required in all math foundations.

1. CS 3300, Data Wrangling (**new**) ⎯⎯⎯(3)
2. CS 3500, Software Practice I ⎯⎯⎯(4)
3. CS 4150, Algorithms ⎯⎯⎯(3)

Core Data Science

2.5 GPA required to graduate.

1. CS 5140, Data Mining ⎯⎯⎯(3)
2. CS 5350, Machine Learning ⎯⎯⎯(3)
3. CS 5530, Database Systems ⎯⎯⎯(3)
4. CS 5630, Visualization ⎯⎯⎯(3)

Elective Advanced Data Analysis

Must choose 3 classes. 2.5 GPA required to graduate. Below are just examples.

1. Math 5080, Statistical Inference 1 ⎯⎯⎯(3)
2. Math 5090, Statistical Inference 2 ⎯⎯⎯(3)
3. CS 4300, Artificial Intelligence ⎯⎯⎯(3)
4. CS 5150, Advanced Algorithms ⎯⎯⎯(3)
5. CS 5190, Probabilistic Learning ⎯⎯⎯(3)
6. CS 5340, Natural Language Processing ($\star$) ⎯⎯(3)
7. CS 5530, Human Computer Interactions ⎯⎯(3)
8. CS 5640, Image Processing ($\star$) ⎯⎯⎯(3)
9. CS 6530, Database Systems ⎯⎯⎯(3)

Starred courses ($\star$) count as data domain courses.

Elective Data Domain

Must choose 3 classes. Below are just examples.

1. CS 5340, Natural Language Processing ⎯⎯⎯(3)
2. CS 5640, Image Processing ⎯⎯⎯(3)
3. ATMOS 1020, Climate Change ⎯⎯⎯(3)
4. ECON 2010, Princ of MicroEconomics ⎯⎯(3)
5. ECON 2020, Princ of MacroEconomics ⎯⎯(3)
6. ECON 5190, Health Economics ⎯⎯⎯(3)
7. GEOG 3400, Population Geography ⎯⎯⎯(4)
8. GEOG 5140, Methods in GIS ⎯⎯⎯(4)
9. GEOG 5150, Spatial Data Design GIS ⎯⎯⎯(4)
10. GEO 1110, Intro to Earth Systems ⎯⎯⎯(3)
11. GEO 3060, Structural Geo and Tectonics ⎯⎯(3)
12. GEO 3070, Petrology for Engineers ⎯⎯⎯(3)

Capstone Requirements

Choose ONE set (to be replaced with DS-specific ones):

1. CS 4000, Senior Capstone Design ⎯⎯⎯(3)
2. CS 4500, Senior Capstone Project ⎯⎯⎯(3)

or

1. CS 4940, Undergraduate Research ⎯⎯⎯(3)
2. CS 4970, Bachelors Thesis ⎯⎯⎯(3)

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*Must reach total of at least 122 credit hours. This degree requires at least 108 hours.

[1]Students may test out of CS 1030.

Example 4 year plan (skip CS 1030)

Year 1

Fall Semester (14 credits)
- CS 1410, Object-Orient. Prog. ——————(4)
- Math 1310, Engineering Calculus I (QR) ————(4)
- [[Wrtg 2010, Intermediate Writing (WR2)]] ———(3)
- ELEC:[GEO 1110, Intro to Earth Systems (⋆)] ——(3)

Spring Semester (17 credits)
- CS 2100, Discrete Structures ——————(3)
- CS 2420, Algorithms/Data Struct. —————(4)
- Math 1320, Engineering Calculus II (QR) ————(4)
- [[Wrtg 3012 or 3014 or 3015 (CW)]] ————(3)
- [[Elective]] ——————(3)

Year 2

Fall Semester (17 credits)
- CS 3500, Software Practice ——————(4)
- CS 4964, Foundations of Data Analysis ————(3)
- Math 3070, Applied Statistics I —————(4)
- [[CS 4962, Ethics and Data Science (BF)]] ———(3)
- ELEC:[GEO 3060, Structural Geo and Tectonics (⋆)] (3)

Spring Semester (14 credits)
- Math 2270, Linear Algebra ——————(4)
- Math 3080, Applied Statistics II —————(4)
- CS 3300, Data Wrangling ——————(3)
- ELEC:[GEO 3070, Petrology for Engineers (⋆)] ——(3)

Year 3

Fall Semester (15 credits)
- CS 4150, Algorithms ——————(3)
- CS 5350, Machine Learning —————(3)
- [[Fine Arts 1 (FF)]] ——————(3)
- [[Elective]] ——————(3)
- [[Elective]] ——————(3)

Spring Semester (15 credits)
- CS 5140, Data Mining ——————(3)
- CS 5630, Database Systems —————(3)
- ELEC:[CS 4300, Artificial Intelligence] ————(3)
- [[Fine Arts 1 (FF)]] ——————(3)
- [[Humanities 2 (HF)]] —————(3)

Year 4

Fall Semester (15 credits)
- CS 4000, Senior Capstone Design ————(3)
- CS 5630, Visualization for Data Science ———(3)
- ELEC:[Math 5080, Statistical Inference 1] ———(3)
- [[Humanities 1 (HF)]] —————(3)
- [[Elective]] ——————(3)

Spring Semester (15 credits)
- CS 4500, Senior Capstone Project ————(3)
- ELEC:[Math 5090, Statistical Inference 2] ———(3)
- [[Social/Behavioral Science 1 (BF)]] ————(3)
- [[American Institutions (AI)]] ————(3)
- [[Elective]] ——————(3)

Example 4 year plan (take CS 1030)

Year 1

Fall Semester (17 credits)
- CS 1030, Foundations of CS —————(3)
- Math 1310, Engineering Calculus I (QR) ————(4)
- [[Wrtg 2010, Intermediate Writing (WR1)]] ———(3)
- [[American Institutions (AI)]] ————(3)
- [[Elective]] ——————(3)

Spring Semester (17 credits)
- CS 1410, Object-Orient. Prog. ——————(4)
- CS 2100, Discrete Structures ——————(3)
- Math 1320, Engineering Calculus II (QR) ————(4)
- [[Wrtg 3012 or 3014 or 3015 (CW)]] ————(3)
- [[Social/Behavioral Science 1 (BF)]] ————(3)

Year 2

Fall Semester (14 credits)
- CS 2420, Algorithms/Data Struct. —————(4)
- Math 3070, Applied Statistics I —————(4)
- [[CS 4962, Ethics and Data Science (BF)]] ———(3)
- [[Humanities 1 (HF)]] —————(3)

Spring Semester (15 credits)
- Math 2270, Linear Algebra ——————(4)
- Math 3080, Applied Statistics II —————(4)
- CS 3300, Data Wrangling ——————(3)
- CS 3500, Software Practice ——————(4)

Year 3

Fall Semester (16 credits)
- CS 4964, Foundations of Data Analysis ————(3)
- CS 4150, Algorithms ——————(3)
- [[Humanities 2 (HF)]] —————(3)
- [[Fine Arts 1 (FF)]] ——————(3)
- ELEC:[GEOG 3400, Population Geography (⋆)] ——(4)

Spring Semester (13 credits)
- CS 5140, Data Mining ——————(3)
- CS 5350, Machine Learning —————(3)
- ELEC:[CS 5530, Human Computer Interactions] ——(3)
- [[Elective]] ——————(4)

Year 4

Fall Semester (15 credits)
- CS 4940, Undergraduate Research ————(3)
- CS 5630, Visualization for Data Science ———(3)
- ELEC:[CS 5340, Natural Language Processing (⋆)] —(3)
- ELEC:[CS 5640, Image Processing (⋆)] ————(3)
- [[Elective]] ——————(3)

Spring Semester (15 credits)
- CS 4970, Bachelors Thesis ——————(3)
- CS 5630, Database Systems —————(3)
- ELEC:[CS 5190, Probabilistic Learning] ————(3)
- ELEC:[CS 4300, Artificial Intelligence] ————(3)
- [[Fine Arts 2 (FF)]] ——————(3)