

## Degree or program proposed: Bachelor of Science in Data Science

### A. Program Overview

1. The University of Hawai'i at Hilo has been approved by the Board of Regents to initiate a new Bachelor of Science degree in Data Science at the UH Hilo Campus located at 200 W. Kawili Street, Hilo, HI. The proposed BS in Data Science includes four subject matter tracks and a core data science curriculum that will help to train our students and build a workforce to address these market demands. As envisioned, the BS in Data Science will play an essential role in meeting both the imperatives outlined in the University of Hawai'i Strategic Plan, particularly those of "Meet Hawai'i's workforce needs for today and tomorrow" and "Diversify Hawai'i's economy through UH innovation and research." The means by which imperatives can be achieved by the Data Science BS also overlap with the alignment with all three goals of the 2021-2031 UH Hilo Strategic Plan:
  - **Goal 1: "UH Hilo will achieve a thriving student-ready equity-minded campus culture by investing in data."** Data-driven insights have the potential to improve student success, equity, and diversity. But this requires not just a single data analyst or office, but rather a culture of data analysis which is shared among the faculty, staff and students. This program will allow us to grow a robust and interdisciplinary data science pipeline, developing such a culture of data generation and analysis throughout the university.
  - **Goal 2: "Making high-impact educational practices available to each student results in more collaborative interdisciplinary opportunities that improves student retention and overall student success."** High-impact practices are a centerpiece of our interdisciplinary data science program. Faculty in our program consistently offer data science research experiences for our students throughout the school year and summer, as well as external data science internships through programs such as the Akamai Internship Program (<https://hilo.hawaii.edu/maunakea/jobs/employer/2>).
  - **Goal 3: "UH Hilo will support and invest in its campus 'ohana through ... fostering interdisciplinary and collaborative efforts that achieve student success."** The data science program is designed to be highly interdisciplinary, allowing students to receive strong CS and math skills and then apply these skills to address challenging problems facing Hawai'i, whether they be in Astronomy, Business, Ecology, etc.
2. The program is not offered at another site nor in a different modality. This is a new program for the University.
3. The anticipated start date for the degree program is August 2024.
4. As Data Science is the fastest growing minor program at the campus, the campus anticipates a robust enrollment. The figures below use a retention rate that matches that of the most recent years in STEM programs at the campus.

Enrollment Projections (3 years)		
Year 1	Year 2	Year 3
10	17	23

5. The program has been fully vetted and approved by campus, system, and Board authorities [Attachment A.5: BOR Approved - UH Hilo BS Data Science provisional request 5.18.23].

6. UH Hilo is authorized by NC-SARA for distance education delivery [Attachment A.6: “UH Hilo NC SARA Authorization”]. No other authorizations are being sought.

7. N/A

## B. Program Description

1. The data science program at UH Hilo is designed to be an interdisciplinary major which teaches students the skills needed to collect, process, store, analyze, and visualize data to drive real-world decisions, in keeping with the campus’ core commitment to hands-on teaching and learning. The core courses in UH Hilo’s Data Science major teach students the computational and statistical principles needed to effectively work with data of various kinds (including images, text, tabular data, etc.) UH Hilo’s proposed major contains four tracks (Business, Astronomy, Computational, and Statistical) in which students receive more in-depth training needed to tackle data science problems in a specific domain. The Data Science faculty plan to add more tracks to the major over time as student interest and enrollment increases. At just under 50 credits, Data Science is designed to facilitate timely completion and to be attractive to freshmen who may want to seek an additional minor or certificate, transfer students, and students interested in a double major.

2. The course list is included in Attachment B.2: Course List for Data Science. All courses, electives, and units are included as requested.

3. The Program Learning Outcomes for the B.S. in Data Science are included in Attachment B.3: Data Science Program Learning Outcomes.

4. A curricular map for the B.S. in Data Sciences is included in Attachment B4: Curricular Map.

5. Most of the Data Science program at UH Hilo is planned to be offered in-person, but some courses may be offered online (synchronous or asynchronous) based on the needs of the program and the modality that the instructor prefers. In these courses, the data science program will ensure academic engagement and faculty-student interaction. In synchronous courses, faculty interact with students through office hours, streamed lectures, and discussions, providing immediate feedback. Regular interaction is maintained in asynchronous courses through online platforms such as discussion boards and virtual office hours, facilitating timely feedback and academic discourse. Instructors who choose to offer their courses in a fully online format will be required to work with the UH Hilo Distance Learning

team to ensure all federal regulations are met, and the quality of student education is maximized. We recognize that modality can have a major impact on student learning, and may alter the modality of key courses if the learning objectives are not being met (see assessment section for how learning outcomes will be assessed).

## C. Faculty Resources

1. The four current Data Science faculty located in CS, Math, Marine Science, and Business will constitute the primary faculty assigned to the new Data Science major, as each is already obligated to teach at least one course in data science and support the development and success of the program. However, the CS and Math departments will share most of the burden and will need to devote more faculty resources over time to teach data science courses as opposed to the traditional courses in their discipline. For Computer Science, this need will be met through the 2.0 FTE hires approved and funded by the legislature in 2022. These positions will either contribute to teaching the data science courses directly, or reallocating the load for existing faculty. For Math, in the short-term lecturers will be used to reallocate faculty workload toward data science the needed faculty resources, with permanent hires in place once demand for the relevant math courses has been established. The track in Astronomy is anticipated to grow in the return of one of the core members of the Data Science faculty, who will be actively expanding into the lead role and establishing further contacts during an approved year long sabbatical.

UH Hilo anticipates that the growth of the degree will be strong and that the certificate program will also remain popular for a broad group of majors. Initially, the courses will be taught by the existing four data science faculty members as well as by 2 new hires in computer science, the latter of whom will primarily contribute to service courses. It is expected that as the enrollment crests in individual programs within Data Science, particularly in the courses that serve multiple majors, additional hires of permanent or temporary appointment, will be necessary. The University will identify which of the disciplines is carrying the highest student-faculty ratio and proceed to hire as appropriate from there. Lecturers will be hired infrequently for the program, but will be hired from time to time in service courses.

The new CS faculty members, 1 tenure-track professor and 1 instructor, provide the additional expertise and time that the data and computer science majors need to grow capacities and continue to broadly support students, and are assumed to have about .5 FTE per person in data science course responsibilities. The core data science faculty will take responsibility for program assessments and curriculum.

New Personnel Costs (incl. 5% annual increase)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Tenure- line Faculty FTE	5.0	5.0	5.0	6.0	6.0	6.0
Projected New Tenure- line Faculty FTE	0	0	0	1.0	0	0

Projected New Lecturers FTE	0	0	.50	.25	.25	.50
Projected Reallocations FTE	0	0	0	0	0	0

2. UH Hilo does not presently expect to run an intentionally fully online or partially online program in data science. However, there may be a few courses offered online, driven by program needs, student demand and success, and instructor preference during the whole of the student’s course of study.. Instructors who choose to offer their courses in a fully online format within the Data Science major courses will be required to work with the Distance Learning team to ensure all federal regulations are met, and the quality of student education is maximized.

**D. Physical Resources**

1. The B.S. in Data Science will not require new facilities, as current Math and Computer Science classroom and computer lab facilities are suitable for housing the Data Science program, and the courses offered through Business and Astronomy are likewise suitably supported in current classrooms and labs. However, as the program grows its enrollment there will be a need for more classroom and engagement space that can be repurposed from existing UH Hilo space. Although there are two classrooms where data science classes are prioritized (College Hall 5 and LRC 350), no space is currently dedicated to data science research and undergraduate student activities. As the campus refreshes the campus master plan, these areas of note will be included in the needs assessment.

2. N/A

**E. Budget**

1. Provide the budget projections for at least the first three years of the proposed program, based on the enrollment projections and including projected revenues and costs. The budget should include all budgetary assumptions. (A budget template is linked below to provide a model of the level of detail the Committee expects, but use of this template is not required. The template may be modified as appropriate.) (CFRs 3.5, 4.1-4.3)

Using the following assumptions, the B.S. in Data Science can be expected to have a positive revenue stream. Part of the success model for financing Data Science is the interdisciplinary nature, which assures that Data Science students have robust access to courses shared by multiple majors. While not reflected here, the faculty in Data Science have also been significantly active in grants generation, which has increased capacities. Since joining UH Hilo in 2018 and following, they have collectively generated over \$4 million in grants (see appendix).

Assumptions	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
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<b>Enrollment Projections (Headcount)</b>	10	17	28	32	35	43
<b>Enrollment Projections (FTE)</b> *Uses 3 year avg of 84% FTE to HC	8.4	14.28	23.52	26.88	29.4	36.12
<b>Classes Taken/Year</b>	~3 (3.36)	~3 (3.36)	~3 (3.36)	~3 (3.36)	~3 (3.36)	~3 (3.36)
<b>Avg. Class Size (uses University Average)</b>	21	21	21	21	21	21
<b># of Classes (new)</b>	0	4	4	4	0	1
<b>Current and New General Funded Faculty Headcount</b> *Permanent Faculty lines are funded through general funding from the state.	6.0	6.0	6.0	7.0	7.0	8.0
<b>Tuition (Resident, FT)/semester</b>	3,672	3,744	3,816	3,816	3,816	3,816
<b>Tuition (Resident, FT)/credit hour</b>	306	312	318	318	318	318

<b>Student Success Data</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>
<b>Attrition (Year 1 cohort, freshman)</b> *Uses 5 year average STEM disciplines at entry	Entry Year	69.46%	54.5%	47.66%	22.82%	7.48%
<b>Attrition (Year 1 cohort, transfer)</b> *Uses 5 year average STEM disciplines at entry	Entry Year	78.42%	53.82%	26.6%	8.52%	2.66%
<b>Completion (Year 1 cohort, freshman)</b> *Uses 5 year average STEM disciplines at entry	0	.26%	1.16%	23.38%	36.32%	40.46%
<b>Completion (Year 1 cohort, transfer)</b>	.74%	9.84%	34.28%	47.26%	51.22%	52.7%

*Uses 5 year average STEM disciplines at entry						
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Existing Resources/Funding	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Combined Tuition/ Summer/ Course Fees	73,440	124,848	209,664	244,224	267,120	328,176

New Personnel Costs						
Personnel (incl. 5% increase annual faculty salary)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Projected New Salaries (w/fringe for lecturers)	0	0	26,612	107,950	29,340	61,614
Projected Student Support (tutors)	5,000	5,000	5,000	5,000	5,000	5,000
Cumulative New Salaries	5,000	5,000	31,612	112,950	118,340	154,814

New Operating Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
New Operating Costs (new equipment and refresh)	12,000	12,000	12,000	12,000	12,000	12,000

Budget	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total Revenue	73,440	124,848	209,664	244,224	267,120	328,176
Total New Expenses	17,000	17,000	43,612	124,950	130,340	166,814
Difference	56,440	107,848	166,052	119,274	136,780	161,362



## F. Assessment

1. Describe the plan for assessing the program at various stages in the first year including achievement of student learning outcomes.

First Year Assessment Plan					
Learning Outcome	Assessment Tool or Measure	Target or Benchmark	Who is Responsible for Assessment and Analysis?	Information Flow for Use and Dissemination	Consider: Analysis & Results, Actions, Follow-up
Math	Exam Questions or Data Reports	Students can carry out basic statistical analysis without assistance	Grady Weyenberg (or other instructor of MATH 271)	Instructor collects responses from MATH 271 and creates rubrics, DS faculty score responses. Results disseminated to all DS faculty	Trends over time will be noted. A dip in performance will lead to exploration of more effective ways to teach our math/statistics classes, with much focus being on MATH271
Programming	Exam Questions	Students can reason about and improve code in Python without assistance	Travis Mandel	Travis collects responses for a class like CS 172 and creates rubrics, Travis, Grady, Sukhwa grade questions, results disseminated to all DS faculty	Trends over time will be noted. A dip in performance will lead to exploration of more effective ways to teach our intro programming classes, with much focus being on CS 172

In the long term, program effectiveness will be assessed through multiple means:

1. Programmatic assessment: The data science team has crafted a comprehensive plan for WASC-compliant programmatic assessment of student learning outcomes in the data science program (see above). Details available in Appendix: Assessment Matrix and Assessment Plan.
  - a. We have mapped out 11 student learning outcomes for the major to the 17 core data science courses as part of the major (excluding the tracks), indicating High, Medium, and Low Coverage of each SLO. This allows us to quickly identify which courses should



be teaching students each of our learning outcome.

- b. For each of the 11 learning outcomes, we have created an assessment plan. Six of the learning outcomes will be evaluated by selecting exam questions from the relevant courses, which a group of data science faculty will score using rubrics. Two of the learning outcomes will be evaluated by scoring student's programming and data science projects using a targeted rubric. The remaining three of the learning outcomes will be evaluated by scoring a student's written reports, and/or oral presentations at the end of the culminating capstone course.
    - c. If student performance is unexpectedly low for a certain learning outcome, the data science group will seriously discuss this and quickly develop strategies to improve student performance, whether that be through revising the way a certain subject is taught, or even adjusting our major to require additional courses that teach a certain topic.
  2. External Review - Periodically, the data science faculty will invite data science faculty at other institutions to visit UH Hilo to review the program. These external faculty will visit classes, hold meetings with faculty and students, and generate a written report outlining the strengths of the program and giving constructive criticism. Evaluations will be included as a portion of annual assessments and cumulative program reviews.
  3. Alumni Surveys: The degree coordinator will collect permanent emails from graduating students (if this email address is later found to be inactive, faculty will use LinkedIn profiles, etc. to contact the students). After graduation from the Data Science Program, students will receive emails to determine what they have lined up next, to quantify the percent of students that acquire employment in the field of study (both in Hawai'i and elsewhere). We will, in partnership with the Institutional Research Office, create a short survey to gather their responses to 1) employment, 2) employment in field, 3) location of employment (Hawai'i or elsewhere), 4) perceptions of their experience in the program, and 5) perceptions of the program's value to them in the workplace. The survey will go out every three years.
  4. Research measures: Number of research proposals submitted under the umbrella of data science, number of students involved in undergraduate data science research (during the academic year and through summer research experiences)
  5. Enrollment data and graduation outcomes, including persistence and time to degree.

2. N/A