UTAH SYSTEM OF HIGHER EDUCATION

December 1, 2023

Deep Technology Talent Initiative Annual Report

In the 2020 General Session, S.B. 96, *The Emerging Technology Talent Initiative*, otherwise known as Deep Tech, was passed. As part of the statute, $5 million in ongoing funding was appropriated to the program, and the Deep Tech Council was created. Deep Tech refers to cutting-edge breakthroughs based on substantial scientific advances and/or meaningful engineering innovation. The Deep Tech Initiative provides funding to create and expand programs in deep technology to the state's degree-granting institutions.

Board Policy R430, *Deep Technology Talent Initiative*, provides funding to expand programs in deep technology. The Deep Technology Talent Initiative aims to facilitate collaborations that create expanded, multidisciplinary programs or stackable credential programs in both undergraduate and graduate studies that prepare students to work at the research and development level in leading-edge technologies such as:

> Advanced Materials, Autonomous Vehicles, Artificial Intelligence, Cyber Security, Precision Medicine, Machine Learning, Augmented and Virtual Reality, Quantum Computing, Robotics, Nanotechnology, and others.

Talent Ready Utah, within the Office of the Commissioner of Higher Education, provides support to the Utah Board of Higher Education and the Deep Tech Council in all aspects of the program, including the receipt of submissions, coordination of the council, information sessions with institutions, establishing scoring rubrics for submissions, making recommendations to the Board, establishing MOU's between the Commissioner's office and institutions that receive awards, invoicing, data collection, expansion of the Deep Tech program with institutions and industry, and preparing and submitting annual reports to the legislative Education Interim Subcommittee, Higher Education Appropriations Subcommittee, and the Utah Board of Higher Education.

In accordance with Utah Code 53B-26-302, Talent Ready Utah is pleased to submit the 2023 Deep Technology Talent Initiative Annual Report on behalf of the Deep Technology Talent Advisory Council. This report was also submitted to the Education Interim Committee and the Higher Education Appropriations Subcommittee.

Commissioner's Recommendation

This is an informational item; no action is required.

2023 Deep Technology Talent Initiative
Annual Report
For the Utah Board of Higher Education
Prepared By Talent Ready Utah
Office of the Commissioner of Higher Education
October 2023

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1. Deep Technology Talent Initiative 2023 Summary

On behalf of the Utah Board of Higher Education, in 2023, USHE's Talent Ready Utah and the Deep Technology Talent Advisory Council continued to fund educational programs supporting Utah's workforce in Deep Technology skills. During the Spring 2023 round of proposal reviews, the Council selected four institutions as recipients of these awards:

- Southern Utah University (SUU) introduced its Artificial Intelligence and Machine Learning Certificate program.
- The University of Utah implemented Neurotechnology Certificates and Neural-Engineering Graduate Degree Programs.
- Utah State University initiated a workforce preparation program, focusing on Integrated Photonics and Quantum Computing.
- Utah Tech University dedicated resources to train life sciences graduates in precision genomics deep technology.

In addition to these Spring awards, the Fall proposal review recommended six additional programs to receive funding:

- The University of Utah proposed a Transportation Infrastructure Electrification Joint Certificate Program.
- Weber State University introduced a Post-Baccalaureate Certificate in Materials Science and Engineering.
- Utah State University launched new certificates in Remote Sensing and Geospatial Artificial Intelligence.
- The University of Utah designed the Utah Workforce for Biotherapeutics program.
- Southern Utah University established the SUU Training and Online Development Labs, along with a Deep Learning/VR Project.
- Utah Valley University requested an extension for one more year, along with supplemental funding, for the Drone-Based AI Training program.

As for the impact on students and finances:

- A total of 1084 students enrolled in these programs.
- Among them, 211 have successfully completed their respective programs.
- Currently, 55 graduates have found employment in relevant fields.

In terms of financial support:

- The Spring 2023 Round garnered $1.8 million in awards.
- The Fall 2023 Round saw a substantial increase, with $3.9 million awarded.
- As of now, there is still $2.9 million available for future awards and initiatives.

2. University of Utah, Robotics Certificates and Graduate Degree Programs

a. 2022 – 2024, $413,973.00
b. Summary
   i. The University of Utah's Robotics program has made substantial progress in gaining administrative approval. Notable achievements include departmental approvals, a Memo of Understanding (MOU) among relevant departments, and ongoing work toward college-level approval.

      ii.   The program has received enthusiastic support from the Board of Trustees and while preparations for public advertising are underway, some challenges have emerged, such as limited space for new faculty and potential resource constraints due to its popularity.

      iii.   Long-term funding concerns have also been raised. Overall, the program is on track to be included in the 2024-25 academic calendar, with plans for recruitment soon. Addressing space, resource, and funding challenges will be essential as the program progresses.

c.   Data Reporting

      i.   The program has not yet been launched and is in the final stages of curriculum approval and therefore, has no data to report at this time.

d.   Key Activities and Deliverables

      i.   The program curriculum is currently in the final stages of review.

3. University of Utah, Resilient Energy Engineering Certificate

a.   2022 - 2024, $536, 267

b.   Summary

      i.   This program intends to develop the Utah Resilient and Secure Energy Infrastructure Workforce certificate program (Utah Energy Resilient program), which consists of an online AI-enabled energy security and resilience training platform that combines a novel online learning environment with the cyber-physical systems resilience (CPSR) testbed at the University of Utah. The CPSR testbed incorporates a digital real-time simulator, which can simulate, in real-time, a variety of energy systems and processes with real protection and control hardware and real communication networks. The Utah Energy Resilient certificate program will enable students to learn the fundamentals of security and resilience of energy infrastructures, explore emerging applications of artificial intelligence and machine learning on these systems, and gain hands-on experience through remote (and in-person) interactions with the CPSR testbed.

c.   Data Reporting

      i.   Students Enrolled

            1.   Alternative Energy - 18

            2.   Power Systems - 8

            3.   Geoscience - 5

      ii.   Students Completed

            1.   10 anticipated by 2025.

      iii.   Students Relevantly Employed

            1.   Power Systems - 4 students currently working in the power industry.

d. Key Activities and Deliverables
  i. Fall 2023
    1. Renewable and Alternative Energy course offered.
    2. Geoscience for Energy Transition course offered.
    3. Energy Management (ECE Special Topics) offered.

4. Utah Valley University, Drone-Based AI Training

a. 2021 - 2023, $800,590

b. Summary
  i. This project involves a multidisciplinary team of students and faculty from Utah Valley University's Computer, Electrical, and Mechanical Engineering programs. The project focuses on creating an automated wind turbine inspection system using drones, integrating Artificial Intelligence and Machine Learning. Apart from achieving the project's goals and delivering the system, a primary objective is to provide students with valuable hands-on experience and technical skills. This helps meet the growing demand for skilled professionals in fields such as artificial intelligence, machine learning, drone path planning, wind turbine inspection, and renewable energy. The project not only enhances students' technical and interpersonal skills but also contributes to the sustainability and growth of the engineering programs. Results and procedures from the project are integrated into engineering courses. The addition of two post-doctoral researchers aims to enhance research quality, and productivity, and support undergraduate teams. This expansion is expected to yield more publications, patents, and future research proposals.

c. Data Reporting
  i. Students Enrolled
    1. 29
  ii. Students Completed
    1. 29
  iii. Students Relevantly Employed
    1. 14

d. Key Activities and Deliverables
  i. Hired and trained 53 undergraduate students including 22, 9, 17, and 4 from CE, EE, ME programs, and CS department from UVU.
  ii. Hired a master student from the ECE department of Utah State University to work on this project as his thesis.
  iii. Hired two postdoctoral researchers with PhD degrees in Mechanical Engineering and Computer Science.

iv.   Developed a new ECE Machine Learning & Drone Lab at the engineering department of UVU.

v.   Published 9 peer reviewed conference papers with undergraduate students.

vi.   Presented 18 posters at conferences with undergraduate students.

vii.   Submitted one journal article with undergraduate students.

viii.   Drafted 4 journal articles and 3 conference papers to be submitted.

ix.   Received a poster award at the IETC 2022 conference hosted by UVU in May 2022.

x.   Received a paper award at the IETC 2023 conference hosted by BYU in May 2023.

xi.   4 undergraduate students completed their internships based on their obtained skills from this project.

xii.   14 students entered the high-tech workforce (13 entered Utah workforce).

xiii.   8 Capstones/Senior Design projects were defined and completed under this project in Spring 2022, Fall 2022, and Spring 2023 with 17 students involved.

xiv.   4 Capstones/Senior Design projects are currently defined under this project to be completed in Fall 2023 and Spring 2024, with 12 students involved.

xv.   Incorporated the project outcomes into 3 courses in ECE and ME programs.

xvi.   Successfully finished Phase II of the project which involved the following goals.

    1.   Developing path planning algorithms for exploring the area of interest for detecting pedestal fans and small wind turbines (small-scale case scenario).

    2.   Developing 5 machine/deep learning architectures and algorithms for small wind turbine detection problems.

    3.   Developing 4 machine/deep learning architectures and algorithms for small wind turbine blade anomaly detection (cracks, holes, and erosion).

    4.   Developing software to integrate the above items all together.

    5.   FAA Part 107: Two undergraduate students received the license to be able to fly the drone for the experiments.

xvii.   Purchased a 5.5 Kw wind turbine to be installed on the UVU campus in November 2023 for the project. The turbine will also be utilized for machine learning and smart grid courses, as well as a demonstration tool for events and outreach purposes to recruit more students into the programs.

xviii.   Developing a wind/solar-based mobile working station for real-time monitoring of the turbine inspection using a drone. This station will also be used for outreach purposes.

5. Weber State University, Autonomous Vehicles

a. 2021 - 2024, $1,067,400.00

b. Summary

    i. Weber State University's College of Engineering, Applied Science & Technology, along with its Departments of Automotive Technology and School of Computing, have joined forces to create an Autonomous Vehicle Systems Graduate Level Certificate, backed by funding from the Deep Technology Talent Initiative. Their mission involves developing a curriculum with industry collaboration, with a focus on advanced computer science concepts related to autonomous vehicle software. The program's objectives encompass hiring faculty, establishing career pathways, and generating marketing materials to promote the certificate. The plan is to introduce the program to students in its third year, with a curriculum covering computer vision, artificial intelligence, machine learning, and path planning for autonomous vehicles, ensuring graduates are well-prepared for careers in this emerging field.

c. Data Reporting

    i. Students Enrolled

        1. 6

    ii. Students Completed

        1. First graduate certificate is expected to be awarded as early as Spring 2024

    iii. Students Relevantly Employed.

        1. 3 out of the 6 current students are employed at Hill Air Force Base.

d. Key Activities and Deliverables

    i. Curriculum Development

        1. Year 1

            a. Dr. Meher Shaikh was moved to a full-time position to support the AVS certificate development.

            b. Brandon Stevenson and Scott Hadzik from Automotive Technology were added to the project at one-quarter position each.

            c. All three faculty members attended a 12-week bootcamp Society of Automotive Engineers (SAE) Robotics for Autonomous Vehicle Systems Bootcamp from April 2022 to July 2022. The boot camp consisted of practical training for Robot Operating Systems (ROS), Linux OS, Python, Kinematics, and software models for navigation of autonomous systems. Coursework will be used to develop the curriculum for AVS courses.

d. All three faculty attended the Autonomous Driver Assistance (ADAS) and Autonomous Vehicle Technology Conference in San Jose, California from Sept 7 to Sept 8. The conference included subject matter experts in AV from leading companies in the industry.

e. Course Curriculum proposals for the following courses are currently being put through the University Curriculum approval process.

    i. Fundamentals of Autonomous Vehicle Systems

    ii. Advanced Autonomous Vehicle Systems

f. Current offerings for the following courses will be included in the certificate.

    i. Advanced Artificial Intelligence

    ii. Machine Learning

g. The certificate in Autonomous Vehicle Systems is also going through the curriculum approval process.

h. New Course offerings and the new certificate are expected to be approved and included in the 2022-2023 WSU catalog with initial course offerings for Fundamentals of Autonomous Vehicle Systems expected to occur in the Fall of 2023

2. Year 2

a. Marketing material created for the first cohort of students.

b. CS 6300 taught for the first time Fall 2023. It was pushed back from the Spring 2023 schedule due to curriculum change deadlines.

c. 6 students currently enrolled in the CS 6300

d. Certificate made available for CS, ECE, and EE Graduate Students.

e. A publicly available website was created with course content that can be used by other AVS or robotics programs in the state.

ii. Career Pathways

1. Year 1

a. Additional Connections with ASI were made at the ADAS and Autonomous Vehicle Expo in San Jose.

b. Curriculum review for the Fundamentals of Autonomous Vehicle Systems will begin in the Spring of 2023. Curriculum review for Advanced AVS will begin in the Summer of 2023

c. Connections have been made with Amazon at the SL3 site. The warehouse uses several autonomous solutions for goods movement through the warehouse. An outside tour and meeting

were scheduled, but had to be moved out due to COVID travel restrictions for Amazon robotics management.

2. Year 2

    a. The following companies have been contacted regarding review of curriculum and possible internships.

        i. Autonomous Solutions Inc. (ASI)

            1. Our relationship with ASI started strong, with productive initial meetings and connections with several of their employees. Unfortunately, a significant turnover a year into our collaboration led to a loss of our primary contacts within the company.

        ii. Although our outreach efforts have yet to yield results, we found some potential new ASI collaborators at a San Jose ADAS conference.

        iii. We've also been working with the ASPIRE center at USU, which shares a partnership with ASI. We hope this connection will rekindle a partnership with ASI.

        iv. Amazon

            1. Brandon was able to connect us with an individual at Amazon that oversees their in-house robotics operations.

            2. An initial tour and meetup were unfortunately halted due to the company's renewed travel restrictions. We reconnected at the beginning of the year, and we are optimistic about their support in the future.

        v. Firefly Automatix

            1. The initial visit was canceled but is rescheduled for later in the year.

6. Weber State University, Machine Learning Data Science

a. 2021 - 2024, $870,000.00

b. Summary

    i. In the 2022-2023 report of the Machine Learning/Data Science Emerging Technology Initiative, significant strides were made in various facets. The program established the Machine Learning & Data Science Research Center

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(DSRC), investing in advanced equipment and promoting interdisciplinary collaboration. A certification program attracted 21 students, with scholarships awarded and one successful graduate employed. Strategic promotion and curriculum development initiatives were undertaken, and several research projects, spanning topics like student performance prediction and Explainable AI (XAI), were conducted. Notably, the initiative engaged in partnerships with industry leaders for projects in sales optimization and user feedback analysis, while also delving into entity extraction from university course catalogs, contributing to the broader field of data science and machine learning.

c. Data Reporting
   i. Students Enrolled
      1. 21
   ii. Students Completed
      1. 1
   iii. Students Relevantly Employed
      1. 1
d. Key Activities and Deliverables
   i. Infrastructure:
      1. The initiative launched the Machine Learning & Data Science Research Center (DSRC) at WSU. It hosts regular meetings with faculty and industry partners and aims to provide a collaborative and interdisciplinary environment for data science research. Several equipment purchases were made for the DSRC, including high-performance servers and storage arrays.
   ii. Certification Program:
      1. The program attracted 21 students, with a gender distribution of 16 males and 5 females. Additionally, 1 graduate (a Caucasian male) has been employed in a job requiring deep technology skills, indicating successful outcomes.
   iii. Scholarships:
      1. The program awarded 14 scholarships totaling $15,000 to support students in their data science education.
   iv. Promotion and Outreach:
      1. The initiative invested in digital media advertising and email campaigns to promote the program, with expenditures totaling $2,400.
   v. Curriculum Development:
      1. Dr. Dylan Zwick designed a yearlong class sequence focused on industry techniques and processes for data science and machine learning. The curriculum includes tools used in industries and project-based courses in

collaboration with industry partners. Other faculty members also contributed to curriculum development.

      vi. Research Projects:

          1. The report highlights several research projects conducted by the academic and industry partners. These projects cover a wide range of topics, including student performance prediction, the use of Jupyter in the classroom, sentiment and emotion analysis, Explainable AI (XAI), and emotion analysis.

      vii. Industry Projects:

          1. The initiative engaged in projects with industry partners, including Bed Bath & Beyond/Overstock.com and Pulse Labs AI. These projects involve optimizing sales based on logistic efficiencies, clustering, summarizing, and prioritizing video feedback from mobile apps and developing tools for personally identifying information (PII) redaction from mobile app screen recordings.

      viii. Entity Extraction from Course Catalogs:

          1. The initiative worked on entity extraction from course catalogs to identify key concepts from different types of classes and levels at universities.

7. University of Utah, Secure Computing

a. 2021 - 2024, $670,887

b. Summary

    i. The University of Utah's Deep Technology Initiative made significant progress from November 2022 to October 2023, including the completion of three online courses in secure computing and notable growth in student enrollment. They have invested primarily in online course development, with expenditures covering faculty salaries and contracted course creation.

    ii. In the upcoming third year, the project will shift its focus to promoting programs and online courses through various platforms and presentations. Curriculum refinements will also be made based on feedback. This transition follows a year primarily dedicated to online course development, signifying a shift toward program promotion and continuous curriculum improvement.

c. Data Reporting

    i. Students Enrolled

        1. CS 6490 - Network Security

           a. 19

2. CS 6956 - Software and Systems Security
   a. 48
3. CS 6968 - Business Aspects of Security and Privacy
   a. 34
4. CS 6967 - Security Operations
   a. 37

    ii. Students Completed

1. Not reported

    iii. Students Relevantly Employed

1. Not reported

d. Key Activities and Deliverables

    i. Three online courses completed, and one online course is being developed.

1. Software and Systems Security – 100% complete
2. Human Aspects of Security and Privacy – 100% complete
3. Security Operations – 100% complete
4. Network Security – 70% complete

    ii. • Growth in student enrollment numbers in secure computing courses.

8. University of Utah, Fairness in AI

a. 2021 - 2024, $343,383

b. Summary

    i. The University of Utah's project, led by Bei Wang Phillips, focuses on fair AI education. Year 2 highlights include creating educational modules for an existing business course and introducing a new course on Algorithm Fairness in Machine Learning. Collaborative research with a legal non-profit has resulted in a paper on improving access to justice through visualization. The student demographics show diversity, and the project promotes awareness of fair AI and provides open-source educational materials. It equips students with essential skills in algorithmic fairness.

c. Data Reporting

    i. Students Enrolled

1. Modules for MKTG 6600 - Algorithms for Business Decisions
   a. 98
2. CS 3960 - Algorithm Fairness in Machine Learning
   a. 8

    ii. Students Completed

1. One graduate student from the School of Computing

    iii. Students Relevantly Employed

d. Key Activities and Deliverables
  i. Course Development:
      a. Educational modules were provided for an existing Business course (MKTG 6600 - Algorithms for Business Decisions) in Fall 2022, with 98 students enrolled.
      b. A new undergraduate course, CS 3960 - Algorithm Fairness in Machine Learning, was taught in Spring 2023 with eight students enrolled.
  ii. Research Collaborations:
      a. The project collaborated with a non-profit organization in the legal domain, resulting in a paper titled "From Flowchart to Questionnaire: Increasing Access to Justice via Visualization" to be presented at an IEEE conference.
      b. Another research project explored the impact of different types of interactive visualizations on understanding the principles of fair algorithms.
  iii. Student Demographics:
      a. CS 3960 had a 62.5% female and 37.5% male enrollment, with a diverse racial/ethnic composition.
      b. MKTG 6600 had two sessions, with varying gender and racial/ethnic demographics.
  iv. Graduates and Employment:
      1. Specific employment numbers for Year 2 are not available, but approximately 300 MBA, MSBA, and business undergraduate students, along with around 450 CS students, have access to the relevant courses.
  v. Funding:
      1. The project received funding for School of Computing and SCI Institute (Phillips - $71,601) and the David Eccles School of Business (Arul Mishra - $29,924; Himanshu Mishra - $11,624).

9. University of Utah, AI and Robotics

a. 2021 - 2024, $416,200
b. Summary
c. The DL-AIR certificate program conducted recruitment presentations in graduate courses and made efforts to establish student pipelines with two schools. In the second year, nine male students completed the program, with six being white and three Asian. A total of 16

students were admitted, with nine earning the DL-AIR Certificate by Fall 2023. Five students presented two papers at an IEEE conference in 2022, while four students submitted a paper to the IEEE Conference on Multisensor Fusion and Integration 2023. Two students work in Utah, one in Colorado, and one in a Salt Lake City Power Engineering firm. The program shows diverse student participation and significant industry engagement.

d. Data Reporting
    i.   Students Enrolled - 16
    ii. Students Completed - 9
    iii. Students Relevantly Employed - 2

e. Key Activities and Deliverables
    i.   Student Recruitment
         1. Presentations about the DL-AIR certificate program were made in seven graduate courses to inform potential students about the program.
         2. Discussions are ongoing with the David Eccles School of Business and the Spencer Fox Eccles School of Medicine to establish pipelines of students for the program.
    ii. Number of Graduates and Demographics
         1. In Year 2, nine students completed industry-related projects in the Capstone Course and received the DL-AIR Certificate. All of them were male, with 6 being white and 3 being Asian.
    iii. Student Participation Data
         1. A total of 16 students have been admitted to the DL-AIR program.
         2. Nine students successfully earned the DL-AIR Certificate by Fall 2023.
         3. Five students participated in industry projects in the DL-AIR Capstone course in Spring 2022, resulting in two papers presented at an IEEE International Conference.
         4. Four students participated in industry projects in the DL-AIR Capstone course in Spring 2023, leading to the submission of one paper to the IEEE Conference on Multisensor Fusion and Integration 2023.
         5. Two of the participating students are employed in Utah, with one working in Colorado and the other in a Salt Lake City Power Engineering firm.

10. Utah State University and Utah Valley University, I3 Consortium

a. 2021 - 2024, $5,013,900.00
b. Summary

i. The Intermountain Intelligence, Industry, and Security Consortium (I3SC) was established in 2021 as part of the Deep Technology Talent Initiative. It is a collaborative effort involving two Utah universities and nine industry partners, with leadership shared by the Center for Anticipatory Intelligence (CAI) at USU and the Center for National Security Studies (CNSS) at UVU. I3SC aims to bring together academia and industry in the security, intelligence, and technology innovation fields.

ii. In the second year of its existence, I3SC introduced several new educational programs, including the Master of Anticipatory Intelligence at USU and seven additional degrees at UVU to address the changing demands of the intelligence and technology sectors. They also added Campbell Scientific as their ninth industry partner.

c. Data Reporting

    i. Students Enrolled

        1. 560

    ii. Students Completed

        1. 151

    iii. Students Relevantly Employed

        1. Placements expected Spring 2024

d. Key Activities and Deliverables

    i. The I3SC (Intelligence and Information Systems Security Center) has launched the Master of Anticipatory Intelligence program (USU) and will introduce seven new degrees in Fall 2024 (UVU) to meet the evolving demands of the intelligence and technology sectors. In its second year, I3SC added Campbell Scientific as its ninth Industry Partner, strengthening its connection between students and Utah job opportunities while keeping its curriculum up to date with industry feedback.

    ii. Utah's Deep Tech funding has fostered collaboration between campuses, particularly with the state's bio-science industry showing interest in I3SC's Biosecurity track.

    iii. I3SC students made a mark in the Atlantic Council's International Cyber 9/12 competitions in Washington, DC, and Geneva, where they prepared briefings on cyberattack scenarios. Despite being the only undergraduate teams, they reached the semifinals in both locations.

    iv. I3SC partners are addressing emerging tech issues relevant to today's workplace. USU's Center for Anticipatory Intelligence (CAI) hosted a "Demystifying ChatGPT Workshop" to help faculty adapt their teaching methods to incorporate large language models responsibly.

    v. UVU's Emerging Tech Policy Lab has worked on projects for the Utah State Cyber Center and the Utah Cybersecurity Commission, notably creating a

comprehensive report on local government cybersecurity preparedness, which received praise and influenced policy.

    vi. I3SC has enhanced Utah's reputation as a tech and security leader, securing funding from the U.S. Department of Defense and private donations to support student internships and experiential learning.

11.Utah State University, Stackable Data Science

a. 2021 - 2024, $218,576

b. Summary

    i. Notable achievements in Year 2 include the approval and launch of a Data Science minor and graduate certificate programs. Scholarships, new classes, and advertising to attract students were introduced.

    ii. Despite challenges in the approval process, the university remains optimistic about program expansion and plans to recruit more students with scholarships, host industry speakers, and develop new courses. They aim to establish a Data Science and Artificial Intelligence Center and seek project renewal to support these efforts.

c. Data Reporting

    i. Students Enrolled

        1. Data Science Minor

            a. 7

        2. Data Science Graduate Certificate

            a. 4

    ii. Students Completed

        1. None

    iii. Students Relevantly Employed

        1. None

d. Key Activities and Deliverables

    i. Early December 2022: Our proposals for the Data Science minor and Data Science graduate certificate were approved in a meeting of the Board of Trustees, after having been submitted in July 2022.

    ii. January 2023 (Data Science minor) and February 2023 (Data Science graduate certificate): Formal memos of R401 approvals were received from the USU Provost's Office. This was a required step before we could create university catalog entries and start recruiting students into these programs.

    iii. February 2023: We submitted these stackable credentials for inclusion in the university catalog.

iv. March 2023: The stackable credentials were approved and included in the university catalog, which then finally allowed us to advertise to students.

v. March 2023: Advertising began in earnest for the stackable credentials, with the creation of a website (www.math.usu.edu/datascience) and flyers distributed (in print and electronically) across campus. These advertisements included the availability of scholarships for students pursuing these stackable credentials, as well as notification of new classes created with funding from this project.

vi. April-August 2023: Recruitment (into these stackable credentials as well as the newly created classes) and administration of stackable credentials scholarships continued.

12. Utah Tech University, Precision Medicine Functional Genomics

a. 2021 - 2024, $1,032,344.00

b. Summary

1. Over the past year, the program has flourished, with many students on track to complete their studies. The primary objective is to expand industry partnerships and enrich student opportunities. Notable achievements include the establishment of paid Student Research Fellowships in areas such as functional genomics and bioinformatics, providing students with essential research experience.

2. Additionally, the institution is finalizing a pivotal contract with Culmination Bio to validate gene variants associated with conditions like Parkinson's Disease and IBS, involving students in vital research. The Center for Precision Medicine and Functional Genomics continues to grow, led by world-renowned expert Howard McLeod, and is actively advancing initiatives in precision medicine. Furthermore, we've secured federal funding for a Variant Science Graduate Certificate, set to commence in Spring 2024, thanks to the Deep Tech Funded Center for Precision Medicine and Functional Genomics. We've also engaged high school students in functional genomics research and improved our Protein Characterization Certificate program to make it more appealing to students.

c. Data Reporting

i. Students Enrolled - 44

1. Functional Genomics

a. 30

2. Protein Characterization

a. 5

3. Bioinformatics

a. 9

    ii.   Students Completed - 4

1. Functional Genomics

    a. 2

2. Protein Characterization

    0

3. Bioinformatics

    a. 2

    iii.   Students Relevantly Employed - 6

1. Graduated with a Certificate

    a. 2

2. Graduated and took certificate courses.

    a. 4

d. Key Activities and Deliverables

    i.   With the program well established, and many students on track to complete the program this coming year, the main goal is to expand industry partnerships and student opportunities. This program continues to have a tremendous impact on our campus and provides transformational experiences to students. It has opened the door to industry partnerships that would have been previously unattainable. Key activities completed this past year are:

1. Paid Student Research Fellowship

1. Leveraging the Deep-Tech funded Program, we have received philanthropic donations for three Fellowships (paid research experiences). Each Fellowship pays students $5000 each year to work 10 hours/week within a research program. The Fellowships are:

2. Adelmarie Murphy Fellowship in Functional Genomics

3. Currently funding one student in the functional genomics program

2. SET International Student Fellowship

1. Currently funding one student in the Bioinformatics Program

2. Currently funding one student in the functional genomics program

3. Students have reported that they have been able to quit part-time jobs in order to focus on research and academics. The Fellowship also better prepares them for graduate programs.

4. Two of the donors have committed to funding fellowship students next year

3. Variant Validation Contract with Culmination Bio

1. We are presently in the process of approving a contract with Culmination Bio to perform variant validation on clinically significant genes related to Parkinson's Disease and IBS
2. Culmination Bio has identified several undefined gene variants (genes with novel mutations) that may have patient significance but needs to know if these mutations cause disease
3. Students will soon begin validating clinically significant gene variants and will be paid to perform this work on a contract basis
4. We have also had preliminary conversations with a Children's Hospital to develop a Rapid Response Validation Team at Utah Tech that is able to quickly validate gene variants identified in NICU patients to inform medical care. We expect these conversations to be ongoing and reported next year

4. Center for Precision Medicine and Functional Genomics
    1. The center (established last year) continues to expand and we hired Howard McLeod using institutional funding to lead the Center. Howard is world-renowned in the area of Pharmacogenomics
5. The center is currently developing several initiatives in the precision medicine space and we anticipate reporting significant progress on these initiatives in the next report
6. Variant Science Training Program
    1. Our last report outlined Federal Funding that was awarded to develop a Variant Science Graduate Certificate. This funding was only possible due to the existence of the Deep Tech Funded Center for Precision Medicine and Functional Genomics and accompanying programs.
7. Funds for the program were received recently and allowed us to hire a program coordinator and have begun to develop this program with an anticipated start date of Spring 2024
8. Other Considerations
    1. We currently have one high-school student doing research in the functional genomics lab.
9. The Protein Characterization Certificate has been under-enrolled relative to our projected numbers. We have recently restructured the program and purchased additional equipment to make it more attractive to student enrollments.

13. Southern Utah University, SUU's Artificial Intelligence and Machine Learning Certificate

a. 2023 - 2025, $367,113.00
b. Summary
    i. The Artificial Intelligence and Machine Learning Certificate (AI&ML) was awarded during the Spring 2023 Deep Technology Talent Initiative review cycle and is not expected to report until 2024.
    ii. To address the state's tech-based economic growth strategy and fill the proficiency demands of state and local tech firms, Southern Utah University (SUU) proposes the creation of a Certificate in Artificial Intelligence and Machine Learning for Engineering Applications that aims to better prepare students to be workforce participants in engineering-related positions that require a background in AI&ML, as well as AST (including fiber optic and wireless sensing).
    iii. The goal of the certificate program is to train engineers in AI&ML methods and applications, enabling them to effectively integrate these technologies into their work. This program recognizes the need for a skilled workforce that comprehends the underlying principles of AI&ML and can apply them in practical engineering settings. By offering this training, the program aims to close the skills gap and fulfill the increasing demand for professionals with these capabilities in Utah's engineering industry.
    iv. To ensure the program's relevance and alignment with industry needs, a comprehensive curriculum will be developed in partnership with industry leaders like SkyWest Airlines, RAM Aviation, and InnovaTech, as well as input from agencies such as the Utah Department of Transportation and the Department of Energy. The courses will stay current with the latest industry trends, tools, and technologies in AI&ML. This collaborative curriculum approach is designed to produce graduates who possess the expanded skills and knowledge required to excel in the workforce and meet the demands of the engineering industry in Utah.
c. Data Reporting
    i. Target Students Enrolled/Completed/Employed - 40
d. Planned Key Activities and Deliverables
    i. June 2023 - Kick-off meeting with advisory board
    ii. June 2023 - Finalize workforce demand.
    iii. July 2023 - Course-by-course evaluation of proposed curriculum.
    iv. Aug 2023 - AI&ML lab development
    v. Dec 2023 - First cohort of 40 students begin in the AI&ML Certificate
    vi. Apr 2024 - First cohort begins second semester.
    vii. Aug 2024 - First cohort begins final semester.

Sep 2024 - Year 1 Report

14. University of Utah, Neurotechnology Certificates & Neuro-Engineering Graduate Degree Programs

a. 2023 - 2025, $667,226.00

b. Summary

    i. The Neurotechnology Certificates & Neuroengineering was awarded during the Spring 2023 Deep Technology Talent Initiative review cycle and is not expected to report until 2024.

    ii. This program intends to develop stackable certificates and graduate degrees in neurotechnology and neuroengineering – rapidly emerging fields of deep technology at the intersection of neuroscience, engineering, artificial intelligence, and medical devices. Neuro-engineers are leading the development of revolutionary neurotechnologies. Examples include brain-machine interfaces for virtual/augmented reality, implanted biomedical devices for treating neurological disorders, brain-inspired artificial intelligence, thought-controlled robotic arms, and biophotonic nanointerfaces for treating psychiatric disorders. Utah has long been a hub for neuroengineering research, and workforce demand is now growing rapidly. This proposal would enable new interdisciplinary and stackable education for undergraduates, graduate students, and industry employees to fulfill our workforce needs and attract new talent to Utah.

c. Data Reporting

    i. Target Students Enrolled/Completed/Employed

        1. 15-20 Neurotechnology Undergraduate Certificates

        2. 5-15 Neurotechnology Graduate Certificates

        3. 5-10 Neuroengineering MS

        4. 5-12 Neuroengineering PhDs.

d. Key Activities and Deliverables

    i. Development of the Neuroengineering Lab course

    ii. Create Neuroengineering and Neurotechnology certificates.

    iii. First graduate in Spring of 2025

15. Utah State University, Preparing Utah workforce: from Integrated Photonics to Quantum Computing

a. 2023 - 2024, $297,000.00

b. Summary

        i.   The Preparing Utah workforce program was awarded during the Spring 2023 Deep Technology Talent Initiative review cycle and is not expected to report until 2024.

       ii.   This program intends to build an interdisciplinary Photonics Lab and a lab-based course as the centerpiece of (1) two certificates of proficiency for Physics and ECE undergraduates, respectively, to steer their careers toward photonics and (2) a graduate certificate for USU MS degree students and working adults with BS degrees to expand their skills or prepare for MS/PhD degrees in photonics.

c.   Data Reporting

       i.   Target Students Enrolled/Completed/Employed - 20

d.   Key Activities and Deliverables

       i.   Year 1: Summer Semester, 2023

           1.   Submit Photonics Lab course and three certificate programs to Board of Regents for approval.

           2.   Work with academic partners to design lab modules and identify instruments.

           3.   Discuss with industry partners on Photonics Lab modules and curricula of EM and Optics courses in the program.

       ii.   Fall semester (Sep-Dec), 2023

           1.   Continue designing lab modules.

           2.   Procure instruments and parts.

           3.   Assemble and test modules.

           4.   Discuss with partners and collaborators.

     iii.   Spring semester (Jan-May), 2024

           1.   Continue procuring instruments and parts.

           2.   Continue assembling and testing modules.

           3.   Write lab manuals.

           4.   Discuss with partners and collaborators.

     iv.   Year 2 (no cost extension) and thereafter

           1.   Certificate programs will begin in the fall semester and will continue thereafter, including the Photonics Lab course in each spring semester.

           2.   Provide experimental setups for undergraduate research in the summer and fall semesters.

           3.   Revise lab modules and manuals.

           4.   Equipment maintenance and updates.

           5.   Fabricate devices for lab use at NDL.

           6.   Meet with industry partners.

           7.   Track student placements when applicable

16. Utah Tech University, Training Life Science Graduates (BioML)

a. 2023 - 2025, $468,752.00

b. Summary

   i. The Training Life Science Graduates program (BioML) was awarded during the Spring 2023 Deep Technology Talent Initiative review cycle and is not expected to report until 2024.

   ii. The BioML initiative is designed to prepare individuals aspiring to integrate machine learning within their existing or future careers in the life sciences. We propose three distinct certificates to engage students at various levels of their education and professional careers: (1) an introductory certificate for high schoolers and lower-level college students; (2) a certificate of proficiency for upper-level undergraduate biology students that builds a foundation in machine learning within the life sciences; and (3) a graduate certificate in machine learning in biology for working professionals in the life sciences industry seeking to upskill. Utah Tech faculty will work closely with industry to deliver applied content that trains students in a unique skill set that will empower them to pursue a variety of careers at the intersection of life sciences and artificial intelligence. Potential career paths include bioinformatics, data analytic biostatistics and computational biology. As Utah life science companies increasingly adopt machine learning into their workflows, our certificate programs will cultivate a diverse talent pool addressing both current and future job market demands.

c. Data Reporting

   i. Students Enrolled
      1. Certificate in Machine Learning - 5
      2. Certificate of Proficiency: ML Biology - 3
      3. Graduate Certificate ML in Biology - 10

   ii. Students Completed
      1. Graduate Certificate ML in Biology - 8

   iii. Students Relevantly Employed
      1. Graduate Certificate ML in Biology - 7

d. Key Activities and Deliverables

   i. Year 1
      1. Hire and onboard biologists with ML training.
      2. Start approval process for curriculum.
      3. Student recruitment

   ii. Year 2
      1. Launch certificate courses.
      2. Develop a graduate certificate.

3. Launch graduate certificate.
        iii.   Year 3
                    1. Second cohort in graduate certificate
                    2. Third cohort in graduate certificate