



**SOUTH DAKOTA BOARD OF REGENTS**  
**ACADEMIC AFFAIRS FORMS**  
**New Specialization**

<b>UNIVERSITY:</b>	University of South Dakota
<b>TITLE OF PROPOSED SPECIALIZATION:</b>	Artificial Intelligence
<b>NAME OF DEGREE PROGRAM IN WHICH SPECIALIZATION IS OFFERED:</b>	M.S. Computer Science
<b>INTENDED DATE OF IMPLEMENTATION:</b>	Fall 2021
<b>PROPOSED CIP CODE:</b>	11.0102
<b>UNIVERSITY DEPARTMENT:</b>	Computer Science
<b>UNIVERSITY DIVISION:</b>	College of Arts & Sciences

**University Approval**

To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.

*Elizabeth M. Freeburg*

3/19/2020

Institutional Approval Signature

Date

*President or Chief Academic Officer of the University*

**1. Level of the Specialization:**

Baccalaureate       Master's       Doctoral

**2. What is the nature/purpose of the proposed specialization?**

The Department of Computer Science proposes developing a specialization in Artificial Intelligence for the M.S. in Computer Science. The M.S. specialization will utilize new and existing coursework within the current Computer Science graduate curriculum. Artificial Intelligence (AI) is one of the most vital and fast-growing fields within Computer Science, with impact in every stratum of society. As such, providing expanded programs in AI will help prepare current and future USD students to meet workforce needs in the state, region, and beyond.

AI specialization involves courses, such as high-performance computing, distributed systems, machine learning, and data mining. These topics/courses are also considered to be taught in several different application domains and/or programs, such as biology, health sciences, physics, chemistry, and business data analytics, just to name a few.

**3. Provide a justification for the specialization, including the potential benefits to students and potential workforce demand for those who graduate with the credential.<sup>1</sup>**

According to both its statutory mission and its mission as provided in BOR policy, USD is charged with offering both liberal arts and professional education. As programs supported

<sup>1</sup> For workforce related information, please provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.

across the existing liberal arts curriculum and engaged in current technological developments, the proposed specialization will also provide students with skills that are urgently needed within South Dakota.

At present, no SDBOR programs in Artificial Intelligence exist. The closest match to this proposed AI program is the undergraduate Data Science major and minor at SDSU. The primary difference is that the USD programs will offer hands-on projects involving several different applications, unlike SDSU's program that primarily relies on statistics coursework.

According to the Bureau of Labor Statistics (BLS), employment of computer and information technology occupations is projected to grow 12% from 2018 to 2028, much faster than the average for all occupations. These occupations are projected to add about 546,200 new jobs. Demand for these workers will stem from greater emphasis on cloud computing, the collection and storage of big data, and information security. Considering all computer science jobs, the median annual wage for computer and information technology occupations was \$86,320 in May 2018, which was higher than the median annual wage for all occupations of \$38,640.

Based on BLS data, graduates with an AI specialization are and will be in great demand. Conventionally, graduates with this background would be candidates for the position of information research scientist<sup>2</sup>. Such a job is projected to grow by 16% by 2028, and the average salary for an MS graduate at present is \$118,370.00 (2018 median pay). Another application domain is information security, and the BLS is projected that the number of jobs will be increased by 37% across the states, where AI and machine-learning tools are now expected. Another important application domain is the finance industry, where artificial intelligence tools are considered as complementary tools for risk management<sup>3</sup>. The employment of financial managers is projected to grow 18.7% (2016 – 2026)<sup>4</sup>.

AI is not just limited to one domain; it includes data analytics, statistics computational chemistry, physics, biology, and health sciences (just to name a few). Regardless of source of data (big data), there is a strong need for AI/Data analysts to interpret data, make decisions, and visualize output.

In South Dakota alone (using the BLS data)<sup>5</sup>, we observe similar trends in computing jobs. Computing jobs, such as computer and information analyst, programmer, game developer, and data analyst will increase by minimum 3% (and maximum on average 16%) by 2028.

On the whole, the primary purpose for proposing this program is workforce development, as the United States anticipates dramatic workforce demand in computer science professionals. If we just address computer and information research scientist jobs, we observe that these professionals have a median pay of \$111,840 per year across the United States (2018).

The proposed program can also be considered as bridge for several different programs, departments, and divisions across the USD campus. Our human intelligence with artificial

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<sup>2</sup><https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm>

<sup>3</sup><https://www.bls.gov/opub/btn/volume-7/in-the-money-occupational-projections-for-the-financial-industry.htm>

<sup>4</sup> Percentage in North American Industry Classification System (NAICS) 520000 (Source: U.S. Bureau of Labor Statistics)

<sup>5</sup> [https://www.bls.gov/oes/2018/may/oes\\_sd.htm#15-0000](https://www.bls.gov/oes/2018/may/oes_sd.htm#15-0000)

intelligence has the potential to help develop research in academic and industrial communities as we live in the world of big data. At present time there is a high demand for students with a basic knowledge of AI.

**4. List the proposed curriculum for the specialization (including the requirements for completing the major – *highlight courses in the specialization*):**

Prefix	Number	Course Title <i>(add or delete rows as needed)</i>	Credit Hours	New (yes, no)
<b>Specialization: Artificial Intelligence</b>				
<b>Select 9 credit hours from the following core courses:</b>				
CSC	721	Distributed Systems	3	No
CSC	722	Machine Learning Fundamentals	3	No
CSC	752	Computer Vision	3	No
CSC	761	Advanced Artificial Intelligence	3	No
CSC	785	Information Storage and Retrieval	3	No
<b>Subtotal</b>			<b>9</b>	
<b>Select 6 credit hours from the following elective courses:</b>				
CSC	525	High Performance Computing	3	No
CSC	586	Data Mining	3	No
CSC	557	Data Analysis, Decision Making, and Visualization	3	Yes
CSC	588	Pattern Recognition and Machine Learning	3	Yes
STAT	580	Applied Statistics	3	No
STAT	581	Probability and Statistics	3	No
<b>Subtotal</b>			<b>6</b>	
Total number of hours required for completion of specialization			<b>15</b>	
Total number of hours required for completion of major			<b>30</b>	
Total number of hours required for completion of degree			<b>30</b>	

**5. Delivery Location<sup>6</sup>**

**A. Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an on-line program)?**

	Yes/No	Intended Start Date
<b>On campus</b>	Yes	Fall 2021

	Yes/No	If Yes, list location(s)	Intended Start Date
<b>Off campus</b>	No		

	Yes/No	If Yes, identify delivery methods <sup>7</sup>	Intended Start Date
<b>Distance Delivery (online/other distance delivery methods)</b>	No		

<sup>6</sup> The Higher Learning Commission (HLC) and Board of Regents policy requires approval for a university to offer programs off-campus and through distance delivery.

<sup>7</sup> Delivery methods are defined in [AAC Guideline 5.5](#).

**B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the certificate through distance learning (e.g., as an on-line program)?<sup>8</sup>**

	<b>Yes/No</b>	<b><i>If Yes, identify delivery methods</i></b>	<b><i>Intended Start Date</i></b>
<b>Distance Delivery (online/other distance delivery methods)</b>	No		

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<sup>8</sup> This question responds to HLC definitions for distance delivery.



**SOUTH DAKOTA BOARD OF REGENTS**  
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**New Course Request**

<b>USD</b>	<b>Arts &amp; Sciences/Computer Science</b>
<b>Institution</b>	<b>Division/Department</b>
<i>Elizabeth M. Freeburg</i>	3/23/2020
<b>Institutional Approval Signature</b>	<b>Date</b>

**Section 1. Course Title and Description**

Prefix & No.	Course Title	Credits
CSC 457/557	Data Analysis, Decision Making, and Visualization	3

Course Description
The course aims to deliver fundamental ideas on analyzing data with the help of statistics, implementing scientific decisions using machine learning tools/techniques, and visualizing them for production at the output in accordance with the user's need. The course employs current programming languages appropriate to the discipline.

**Pre-requisites or Co-requisites**

Prefix & No.	Course Title	Pre-Req/Co-Req?
CSC 155/155L	Introduction to Computer Science & Programming	Pre-Req.

**Registration Restrictions**

N/A
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**Section 2. Review of Course**

**2.1. Was the course first offered as an experimental course (place an "X" in the appropriate box)?**  
 Yes (if yes, provide the course information below)       No

**2.2. Will this be a unique or common course (place an "X" in the appropriate box)?**

*If the request is for a unique course, verify that you have reviewed the common course catalog via Colleague and the system [Course Inventory Report](#) to determine if a comparable common course already exists. List the two closest course matches in the common course catalog and provide a brief narrative explaining why the proposed course differs from those listed. If a search of the common course catalog determines an existing common course exists, complete the Authority to Offer an Existing Course Form.*

**Unique Course**

Prefix & No.	Course Title	Credits
CSC 486/586	Data Mining	3
CSC 460	Scientific Visualization	3

*Provide explanation of differences between proposed course and existing system catalog courses below:*

CSC 486/586 is a course that explores data, especially large data; however, CSC 486/586 does not incorporate the decision making and visualization component that CSC 457/557 offers. The proposed course has a capability to deliver fundamental ideas on analyzing data, implementing scientific decisions using machine learning tools/techniques that are built upon statistical modeling, and visualizing them for production at the output in

accordance with the user's need. CSC 486/586 does not incorporate decision-making and data/decision visualization components. CSC 460 is limited to visualization.

### **Section 3. Other Course Information**

#### **3.1. Are there instructional staffing impacts?**

- No.** Schedule Management, explain: This course will be taught with current faculty. CSC 457/557 will be part of the regular faculty teaching load on the course rotation. No new hiring will be necessary.

#### **3.2. Existing program(s) in which course will be offered:** B.A./B.S./M.S. in Computer Science.

#### **3.3. Proposed instructional method by university:** D Discussion/Recitation

#### **3.4. Proposed delivery method by university:** U01: Face-to-face Term Based Instruction and U15/U18 Online if offered during summer term.

#### **3.5. Term change will be effective (enter catalog year):** 2020-21

#### **3.6. Can students repeat the course for additional credit?**

- Yes, total credit limit: \_\_\_\_\_  No

#### **3.7. Will grade for this course be limited to S/U (pass/fail)?**

- Yes  No

#### **3.8. Will section enrollment be capped?**

- Yes, max per section: 30  No

#### **3.9. Will this course equate (i.e., be considered the same course for degree completion) with any other unique or common courses in the common course system database in Colleague and the [Course Inventory Report](#)?**

- Yes  No

#### **3.10. Is this prefix approved for your university?**

- Yes  No

### **Section 4. Department and Course Codes (Completed by University Academic Affairs)**

#### **4.1. University Department Code:** UCSC

#### **4.2. Proposed [CIP Code](#):** 11.0701

*Is this a new CIP code for the university?*  Yes  No



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<i>Elizabeth M. Freeburg</i>	3/23/2020
<b>Institutional Approval Signature</b>	<b>Date</b>

**Section 1. Course Title and Description**

Prefix & No.	Course Title	Credits
CSC 488/588	Pattern Recognition & Machine Learning	3

Course Description
This course covers fundamental concepts, theories, and algorithms for pattern recognition and machine learning. It includes basic ideas on probability and statistics, parametric and non-parametric learning, data clustering, support vector machine, and neural networks. It covers multiple applications, such as pattern recognition in bioinformatics and pattern analysis & machine intelligence in healthcare.

**Pre-requisites or Co-requisites**

Prefix & No.	Course Title	Pre-Req/Co-Req?
CSC 155/155L	Introduction to Computer Science & Programming	Pre-Req.

**Registration Restrictions N/A**

**Section 2. Review of Course**

**2.3. Was the course first offered as an experimental course (place an "X" in the appropriate box)?**  
 Yes (if yes, provide the course information below)       No

**2.4. Will this be a unique or common course (place an "X" in the appropriate box)?**

**Unique Course**

Prefix & No.	Course Title	Credits
CSC 448/548	Machine Learning	3
CSC 449/549	Advanced Topics Artificial Intelligence	3

*Provide explanation of differences between proposed course and existing system catalog courses below:*

The scope of the proposed in this new course goes beyond the material covered in the CSC 548/448 Machine learning and CSC 449/549 topics Artificial Intelligence courses. The proposed course covers pattern recognition applications using machine learning tools/techniques. Pattern recognition applications can be varied from healthcare and/or bioinformatics to computational physics and chemistry, where anomaly detection, for example, in large data is crucial.
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**Section 3. Other Course Information**

**3.11. Are there instructional staffing impacts?**

- No.** Schedule Management, explain: This course will be taught with current faculty. CSC-488/588 will be part of the regular faculty teaching load on the course rotation. No new hiring will be necessary.

3.12. Existing program(s) in which course will be offered: B.A./B.S./M.S. in Computer Science.

3.13. Proposed instructional method by university: D Discussion/Recitation

3.14. Proposed delivery method by university: U01: Face-to-face Term Based Instruction and U18 Online Synchronous/U15 Asynchronous

3.15. Term change will be effective (enter catalog year): 2020-21

3.16. Can students repeat the course for additional credit?

Yes, total credit limit: \_\_\_\_\_  No

3.17. Will grade for this course be limited to S/U (pass/fail)?

Yes  No

3.18. Will section enrollment be capped?

Yes, max per section: 30  No

3.19. Will this course equate (i.e., be considered the same course for degree completion) with any other unique or common courses in the common course system database in Colleague and the [Course Inventory Report](#)?

Yes  No

3.20. Is this prefix approved for your university?

Yes  No

#### **Section 4. Department and Course Codes (Completed by University Academic Affairs)**

4.3. University Department Code: UCSC

4.4. Proposed [CIP Code](#): 11.0701

*Is this a new CIP code for the university?*  Yes  No