SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 6 – H
DATE: March 29-30, 2022

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SUBJECT

New Specialization Request – DSU – Specialization in Artificial Intelligence – MS in Computer Sciences

CONTROLLING STATUTE, RULE, OR POLICY

BOR Policy 2:23 – Program and Curriculum Approval

BACKGROUND / DISCUSSION

Dakota State University (DSU) requests authorization to offer a specialization in Artificial Intelligence within the MS in Computer Science. The proposed Artificial Intelligence (AI) specialization is intended to give students a deep understanding of AI related algorithm design, analysis, and implementation. Topics include machine learning, intelligent agents, probabilistic reasoning, and decision making, and others. Coupled with a traditional computer science curriculum, the proposed program will prepare students to apply well researched and documented AI algorithms and methodologies to various fields. AI applications have a wide range of implementations, and students graduating with this degree will be able to work in a wide variety of industries in careers such as: machine learning engineer, data analyst, data scientist, AI/ML researcher, and software engineering

IMPACT AND RECOMMENDATION

DSU requests authorization to offer the specialization on campus and online. DSU is not requesting additional state resources to offer the program. No new courses will be required.

Board office staff recommends approval of the program.

ATTACHMENTS

Attachment I – New Specialization Request: DSU – Artificial Intelligence – MS in Computer Sciences

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DRAFT MOTION 20220329_6-H:

I move to authorize DSU to offer a specialization in Artificial Intelligence within the MS in Computer Science, as presented.

SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Specialization

UNIVERSITY:	DSU
TITLE OF PROPOSED SPECIALIZATION:	**Artificial Intelligence**
NAME OF DEGREE PROGRAM IN WHICH SPECIALIZATION IS OFFERED:	**Computer Science, M.S.**
BANNER PROGRAM CODE:	**DCSC**
INTENDED DATE OF IMPLEMENTATION:	**12/16/2021**
PROPOSED CIP CODE:	**11.0102**
UNIVERSITY DEPARTMENT:	**Computer Science**
BANNER DEPARTMENT CODE:	**DCSI**
UNIVERSITY DIVISION:	**Beacom College of Computer and Cyber Science**
BANNER DIVISION CODE:	**DCOC**

☒ **Please check this box to confirm that:**

- The individual preparing this request has read AAC Guideline 2.6, which pertains to new specialization requests, and that this request meets the requirements outlined in the guidelines.
- This request will not be posted to the university website for review of the Academic Affairs Committee until it is approved by the Executive Director and Chief Academic Officer.

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.

Institutional Approval Signature
President or Chief Academic Officer of the University

9/30/2021
Date

Note: In the responses below, references to external sources, including data sources, should be documented with a footnote (including web addresses where applicable).

1. Level of the Specialization (*place an "X" in the appropriate box*):

Baccalaureate ☐ Master's ☒ Doctoral ☐

2. What is the nature/purpose of the proposed specialization? Please include a brief (1-2 sentence) description of the academic field in this specialization.

This specialization in artificial intelligence is intended to give students a deep understanding of A.I. related algorithm design, analysis, and implementation. Topics include machine learning, intelligent agents, probabilistic reasoning and decision making, among others.

3. Provide a justification for the specialization, including the potential benefits to students and potential workforce demand for those who graduate with the credential. *For workforce related information, please provide data and examples. Data may include, but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc. Please cite any sources in a footnote.*

The purpose of this program is to provide students with the education and training needed to be successful in the many existing and emerging technical fields involving artificial intelligence. (AI) uses data and computational models to make decisions and predictions. AI applications have a wide range of implementations from: determining the best route for delivery trucks, predicting the probability of lung cancer from looking at chest x-rays, classifying weeds in video feeds as tractors drive through fields, giving inventory predictions for businesses, creating autonomous agents in games and movies that act realistically, or instructing a self-driving car to slow down as it approaches a crosswalk. Coupled with a traditional computer science curriculum, the proposed program will prepare graduate students to apply well researched and documented AI algorithms and methodologies to various fields like those mentioned.

In February of 2019, the White House released Executive Order 13859 announcing the American Artificial Intelligence Initiative [1]. Entailed in this document is a national strategy for promoting U.S. leadership in AI, where one of the key policies and practices included training an AI-ready workforce.

Regarding specific careers, job titles include (but aren't limited to): Machine Learning Engineer, Data Analyst, Data Scientist, AI/ML Researcher, and Software Engineer. These jobs provide different roles to help firms make scientific or data-driven decisions or automate tasks to reduce costs or scale products, create physical automated bots for a myriad of purposes, or provide research into new applications. These services pertain to nearly all industries. Consolidating all A.I. related jobs, there has been a steady increase in job-posting, while responses have slightly shrunk; indicating an increased demand while the current workforce is decreasing, leaving a gap to fill. AI job postings on the website Indeed.com saw its largest increase from 2016 to 2017 by 136.3%. In the following years, the spike leveled off, but the percentage of job postings continued to rise by 49.1% and 32% from the previous year in 2018 and 2019 respectively; making machine learning and deep learning engineers the most popular jobs posted that year. An incredible overall increase in the last few years. In contrast, the number of jobs searches only increased by 14% in the last year mentioned, leaving a large number of unfilled positions. Pay for these jobs averages from $97,850 for AI software engineers to $134,449 for machine learning engineers. [2]

In regard to South Dakota, the biggest player in the economy is agriculture. Research and deployment of AI software and robotics will be a key component to increasing crop and livestock production, as well as operational throughput to stay competitive in the regional and national

markets. Also, AI is used in many areas of medical research, which ties into the Sanford and Avera hospitals in the region.

The specialization also falls in line with Dakota State University's mission statement, which is to provide learning that integrates technology and innovation to develop graduates ready to contribute to local, national, and global prosperity.

It's important to note that many new jobs created for degrees such as this are new enough such that they are not listed on the South Dakota Department of Labor's (SDoL) website or the U.S. Bureau of Labor Statistics (BLS). These types of positions include Machine Learning Engineers, Data Scientists, and Applied AI Specialists mentioned earlier from the Indeed resource.

The following tables include positions that could potentially be filled by graduates with this degree. The first table represents the short-term growth projections from 2019 to 2021 by the SDoL [3].

						Average Annual Openings			
SOC Code	SOC Title	2019 Employment	2021 Employment	Numeric Change	Percent Change	Due to Exits	Due to Transfer	Annual Change	Total Opening
15-11-21	Computer Systems Analyst	817	849	32	3.9%	16	44	16	76
15-1132	Software Developers, Applications	1,072	1,145	73	6.8%	16	62	36	114
15-1134	Web Developer	478	500	22	4.6%	8	29	11	48
13-1081	Logisticians	141	143	2	1.4%	4	10	1	15
13-1111	Management Analysts	3,503	3,650	147	4.2%	111	226	74	411
13-1161	Market Research Analyst	1,013	1,074	61	6.0%	24	82	30	136

The numbers in this second table represent the statewide occupational projections from 2018 to 2028 [4].

						Average Annual Openings			
SOC Code	SOC Title	2018 Employment	2028 Employment	Numeric Change	Percent Change	Due to Exits	Due to Transfer	Annual Change	Total Opening
15-1121	Computer Systems Analysts	803	897	94	11.7%	16	45	9	70
15-1132	Software Developers, Applications	1,041	1,300	259	24.9%	16	66	26	108

15-1134	Web Developer	460	523	63	13.7%	8	29	6	43
13-1081	Logisticians	136	150	14	10.3%	3	10	1	14
13-1111	Management Analysts	3,334	3,762	428	12.8%	110	224	43	377
13-1161	Market Research Analyst	993	1,200	207	20.9%	26	86	21	133

On a national level, the long-term job increases include [5]:
*Employment in thousands.

SOC Code	SOC Title	2018 Employment	2028 Employment	Numeric Change	Percent Change	Occupational Openings, Annual Average
15-1121	Computer Systems Analysts	633.9	689.9	56.0	8.8%	53.4
15-1132	Software Developers, Applications	944.2	1,185.7	241.5	26.6%	99.2
15-1134	Web Developer	160.5	181.4	20.9	13.0%	15.1
13-1081	Logisticians	174.9	183.3	8.4	4.8%	17.9
13-1111	Management Analysts	876.3	994.6	118.3	13.5%	99.9
13-1161	Market Research Analyst	681.9	821.1	139.2	20.4%	90.7

[1] http://reports.weforum.org/future-of-jobs-2018/?doing_wp_cron=1596291222.6228919029235839843750

[2] https://www.indeed.com/lead/top-10-ai-jobs-salaries-cities

[3] https://dlr.sd.gov/lmic/documents/short_term_occupational_projections_statewide_2020_2022.pdf

[4] https://dlr.sd.gov/lmic/documents/occupational_projections_2018_2028_statewide_south_dakota.pdf

[5] https://data.bls.gov/projections/occupationProj

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

All MSCS students must take the five core courses listed in the table below. Those students who wish to pursue the A.I. specialization must then take CSC 502 and CSC 547, and then choose three specialization electives listed.

Prefix	Number	Course Title *(add or delete rows as needed)*	Credit Hours	New (yes, no)
Required Courses			**15**	
CSC	705	Design and Analysis of Algorithms	3	No
CSC	710	Structure and Design of Programming Languages	3	No
CSC	718	Operating Systems and Parallel Programming	3	No
CSC	720	Theory of Computation	3	No
CSC	722	Machine Learning Fundamentals	3	No
Artificial Intelligence Specialization			**15**	
CSC	502	Mathematical Foundations of A.I.	3	No
CSC	547	Artificial Intelligence	3	No
Choose 9 credits from the following:			9	
CSC	578	Generative Deep Learning	3	No
CSC	579	Reinforcement Learning	3	No
CSC	723	Machine Learning for Cybersecurity	3	No
INFS	768	Predictive Analytics	3	No
INFS	772	Programming for Data Analytics	3	No
INFS	778	Deep Learning	3	No
INFS	784	Artificial Intelligence Applications	3	No
CSC/INFS/INFA	791/792	Approved Topics and Independent Study	3	No

Total number of hours required for completion of specialization	15
Total number of hours required for completion of major	30
Total number of hours required for completion of degree	30

5. Delivery Location

Note: The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery.

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 specialization through distance technology (e.g., as an on-line program)?

	Yes/No	***Intended Start Date***
On campus	Yes	**Fall** Choose an item. **2022**

	Yes/No	*If Yes, list location(s)*	*Intended Start Date*
Off campus	No		Choose an item. Choose an item.

	Yes/No	*If Yes, identify delivery methods* *Delivery methods are defined in AAC Guideline 5.5.*	*Intended Start Date*
Distance Delivery (online/other distance delivery methods)	Yes	Online	**Fall** Choose an item. **2022**

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the specialization through distance learning (e.g., as an on-line program)? *This question responds to HLC definitions for distance delivery.*

	Yes/No	*If Yes, identify delivery methods*	*Intended Start Date*
Distance Delivery (online/other distance delivery methods)	No		Choose an item. Choose an item.