THE UNIVERSITY OF ARIZONA®

New Academic Program Workflow Form

General

Proposed Name: Natural Language Processing

Transaction Nbr: 00000000000108

Plan Type: Specialization

Academic Career: Undergraduate

Degree Offered: Undergraduate Certificate

Do you want to offer a minor? N

Anticipated 1st Admission Term: Sprg 2022

Details

Department(s):

SBSC

DEPTMNT ID	DEPARTMENT NAME	HOST
0481	School of Information	Y

Campus(es):

MAIN

LOCATION	DESCRIPTION
TUCSON	Tucson

Admission application terms for this plan: Spring: Y Summer: N Fall: Y

Plan admission types:

Freshman: N Transfer: N Readmit: N Graduate: Y

Non Degree Certificate (UCRT only): N

Other (For Community Campus specifics): N

Plan Taxonomy: 11.0101, Computer and Information Sciences, General.

Program Length Type: Program Length Value: 0.00

Report as NSC Program:

SULA Special Program:

Print Option:

Diploma: Y Certificate: Natural Language Processing

Transcript: Y Certificate: Natural Language Processing

Conditions for Admission/Declaration for this Major:

N/A

Requirements for Accreditation:

N/A

Program Comparisons

University Appropriateness

Natural Language Processing is emerging as a dynamic cultural element of the socio-technical landscape of the fourth industrial revolution. UA¿s Strategic Plan focuses on transdisciplinary convergence, to realize the transformative power of emerging data sciences that include natural language processing. The Schools of Information's proposed undergraduate certificate presents a compelling opportunity to build on UA¿s unique strengths in interdisciplinary efforts, advancing the College of Social and Behavioral Sciences strategic plan to offer a broad-based liberal arts education.

Arizona University System

NBR	PROGRAM	DEGREE	#STDNTS	LOCATION	ACCRDT
1	Computational Linguistics Cert	CERTU	10	University of Utah	N
2	Cert. Computational Linguistics	CERTU	15	San Jose State University	N

Peer Comparison

Please see attached chart for full comparison

Faculty & Resources

Faculty

Current Faculty:

INSTR ID	NAME	DEPT	RANK	DEGREE	FCLTY/%
00363284	Richard Thompson	0481	Senior Lecturer	Doctor of Philosophy	1.00
04608422	Michael Hammond	0431	Professor	Doctor of Philosophy	1.00
11709208	Steven Bethard	0481	Assoc. Prof	Doctor of Philosophy	1.00
14104305	Sandiway Fong	0431	Adj. Assoc. Prof	Doctor of Philosophy	1.00
22052443	Peter Jansen	0481	Assit. Prof	Doctor of Philosophy	1.00
22057770	Mihai Surdeanu	0412	Assoc. Prof	Doctor of Philosophy	1.00
23152438	Gustave Hahn-Powell	0431	Assit. Prof	Doctor of Philosophy	1.00

Additional Faculty:

N/A

Current Student & Faculty FTE

DEPARTMENT	UGRD HEAD COUNT	GRAD HEAD COUNT	FACULTY FTE
0481	633	232	38.90

Projected Student & Faculty FTE

	UGRD HEAD COUNT			GRAD HEAD COUNT			FACULTY FTE		
DEPT	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3
0481	648	669	690	293	349	449	38.90	38.90	38.90

Library

Acquisitions Needed:

N/A

Physical Facilities & Equipment

Existing Physical Facilities:

N/A

Additional Facilities Required & Anticipated:

N/A

Other Support

Other Support Currently Available:

N/A

Other Support Needed over the Next Three Years:

N/A

Comments During Approval Process

9/9/2021 12:24 PM

CFBROOKS

Comments
Approved.

THE UNIVERSITY OF ARIZONA

NEW CERTIFICATE PROPOSAL

I. CERTIFICATE DESCRIPTION–provide a marketing description for the proposed certificate. Include the purpose (preparation for professional certification exams, degree program recruitment, or employability enhancement), nature, and program highlights. The description must match departmental and college websites, Degree Search & Academic Advisement Reports / Graduate Catalog and Program Descriptions page, handouts, promotional materials, etc.

The Natural Language Processing (NLP) Certificate will provide undergraduate students the confidence and training they need in natural language processing - teaching computers to use language by extracting knowledge from text, and then using that knowledge in meaningful ways. The certificate will signal to employers that students have dedicated the time and energy necessary to develop the skills and confidence for working from these types of data. The Certificate will serve a diverse student population, training both 1) technically-minded students as well as 2) less technically-minded students in the basic skills necessary for gathering insights from NLP data.

II. NEED FOR THE CERTIFICATE/JUSTIFICATION - describe how the certificate fulfills the needs of the city, state, region, and nation. Provide market analysis data or other tangible evidence of the need for and interest in the proposed certificate. This might include results from surveys of current students, alumni, and/or employers or reference to student enrollments in similar programs in the state or region. Include an assessment of the employment opportunities for graduates of the program during the next three years. Curricular Affairs can provide a job posting/demand report by skills obtained/outcomes/CIP code of the proposed certificate. Please contact the Office of Curricular Affairs to request the report for your proposal.

The Natural Language Processing (NLP) Certificate is distinct in its accessibility for students from across domains, fields, and disciplines at the University. It serves students who may or may not bring experience or prerequisites required of many data-oriented courses and programs on campus.

This program serves students from across the university, and will appeal to students majoring in computer science, linguistics, or information science, functioning as a specialty area for those learners.

Generally, a 112% increase in career placement opportunities is expected for data science degrees from now until 2023 (Looking Glass data). Demand for NLP in particular is growing rapidly, with a market that was $8.61 billion in 2018 projected to reach $80.68 billion by 2026 (Fortune Business Insights).

This certificate program will target:

- working professionals seeking to improve their skills and/or increase their eligibility for promotion,
- students interested in augmenting their current degree program with this particular skill set (e.g., this is a great certificate to add to a major like Computer Science, Linguistics, or Information Science).

Initially, we will target students in Ling./CS/Info. programs that have already taken one or two of the required certificate courses, since they will only need to take two more courses to complete the certificate.

3-Year Projected Annual Enrollment:

- 1st Year, 5 Certificates Awarded
- 2nd Year, 10 Certificates Awarded
- 3rd Year, 20 Certificates Awarded

General Demand:
Students, generally, are living amid a massive shift in the amount of data we can save, use, analyze, and visualize – the Arizona region and students nationally thus need to be prepared for life and work in this data-driven economy:

- The data volumes are exploding: more data has been created in the past two years than in the entire previous history of the human race.
- Every second we create new data. For example, we perform 40,000 search queries every second (on Google alone), which makes it 3.5 searches per day and 1.2 trillion searches per year.
- In Aug 2015, over 1 billion people used Facebook FB +1.31% in a single day.
- Facebook users send on average 31.25 million messages every minute.

Source: http://www.forbes.com/sites/bernardmarr/2015/09/30/big-data-20-mind-boggling-facts-everyone-must-read/#22f2f71c6c1d

Needs Served by the Certificate:
From a recent paper US Bureau of Labor Statistics called "working with big data": The growth in big data will continue to expand the kinds of work that use this information. As mentioned previously, BLS does not collect data specifically about data scientists. Instead, BLS classifies these workers as statisticians or computer programmers or in other occupations. In May 2012, BLS data for wage and salary workers show that there were 25,570 statisticians and 316,790 computer programmers. These occupations had median annual wages of $75,560 and $74,280, respectively— more than double the median annual wage of $34,750 for all workers in May 2012. In fact, wages in mathematics- and computer-related occupations continue to outpace wages in other occupations. According to BLS Occupational Employment Statistics data, median annual wages in these occupations were $76,270 in May 2012, more than double the median wage for all occupations. BLS projects both statisticians and computer programmers to have average employment growth between 2010 and 2020. Statistician, a relatively small occupation, is projected to add about 3,500 new jobs over the decade. The larger occupation of computer programmer is projected to add about 43,700 new jobs during the same period. Workers who use big data are employed by many kinds of institutions and in many different industries: government, businesses, financial institutions, healthcare, scientific research facilities, colleges and universities, and others. The collection and use of big data continues to expand in all of these.

Arizona predictions show that computing and math-related job numbers are on the rise:
2014 - 2024 Estimated Increase for Arizona:

- Computer and Mathematical 0.22%, 26,009 jobs
- Business and Financial Operations 0.17%, 34,773 jobs https://laborstats.az.gov/employment-forecasts
- Data scientists will enjoy one of the brightest job outlooks of all IT occupations through 2020. Data science and analytics is home to a substantial – and fast-growing – talent gap in the IT workforce, meaning there are more job openings than qualified data scientists to fill them.
- 63% of IT executives polled in a 2011 study by leading IT service firm EMC, suggests the demand for data scientists will significantly outpace (31%) or outpace (32%) the supply of talent through 2018. Another comprehensive report from the McKinsey Global Institute forecasts a shortage of up to 190,000 data scientists in the U.S. by 2018.
- Data- and big-data scientists are sought-after at today's top high-tech and social media giants. Search your favorite job boards for "data analyst" or "big data" and you're likely to see companies such as Facebook, LinkedIn, Groupon, Spotify & Amazon seeking fresh talent. These businesses amass incredible amounts of raw data, and understand well the game-changing advantages that await the first-movers to capitalize on the big data explosion.
- Health care is another hot area for data scientist hiring; with its widespread and ongoing migration to electronic patient records, the medical industry is building data sets to rival the largest enterprises. Other industries aggressively hiring big data scientists include government agencies, social networking hubs, big-box retailers and the U.S. military.

Sources: EMC Data Scientist Study, 2011 & McKinsey Global Institute Big Data Report, 2011

Related Employment Positions:

- Artificial Intelligence Engineer
- Computational Linguist
- Data Associate
- Data Analyst
- Data Architect
- Data Engineer
- Data Scientist
- Language Engineer
- Machine Learning Engineer
- Machine Learning Scientist
- NLP Engineer/Scientist
- Research Scientist

Local worksites for data-trained students include:

- Air Force Research Labs (Mesa AZ)
- Lum AI
- Pitch Vantage
- AdviNow Medical
- Leidos
- Databricks
- OpenClass

III. PROGRAM AFFILIATION- specify whether the UA offers an affiliated program at the undergraduate or graduate level. The affiliated program may or may not have the same name as the proposed certificate. Will there be any collaboration with other departments or universities to maximize resources? If there is collaboration, please include a memo (email is acceptable) of support from the applicable parties.

This certificate is a collaboration across the Department of Linguistics, the Department of Computer Science, and the School of Information/iSchool.

IV. CERTIFICATE REQUIREMENTS– complete the table below to list the certificate requirements, including minimum number of credit hours, required core, electives, and any special requirements. Information in this section must be consistent throughout the proposal documents (comparison chart, department checklists, curricular/assessment map, etc.).

UNDERGRADUATE CERTIFICATE

Requirements should include sufficient units to provide a substantive program and an appropriate level of academic rigor and in no case be less than 12 units of credit.

Minimum total units required	12
Minimum upper division units	6
Total transfer units that may apply to the certificate. *Note: A minimum of six (6) units used to complete the certificate must be University credit.*	3
Pre-admissions expectations (i.e., academic training to be completed prior to admission)	none

Certificate requirements. List all certificate requirements including core and electives. Courses listed must include **course prefix, number, units, and title**. **Mark new coursework (New)**. Include any limits/restrictions needed. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	Core: Complete 3 courses (9 units): Either ISTA 130 (4 units) or CSC 110 (4 units) or LING 201 (3 units) or LING 408 (3 units) Either ISTA 355 (3 units) or Ling 388 (3 units) LING/ISTA/CSC 439 (3 units) Electives: Complete at least 3 units from the following: LING 408 (3 units) LING 438 (3 units) LING 478: (3 units) ISTA 131 (3 units) ISTA 455 (4 units) ISTA 456 (3 units) CSC 483 (3 units)
Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	none
Any double-dipping restrictions (Yes/No)? If yes, provide description. *A maximum of 6 units may double-dip with a degree requirement (major, minor, General Education) or second certificate.	None distinct or beyond the University max of 6 units.
Additional requirements (provide description)	none

V. **CURRENT COURSES**–using the table below, list all existing courses included in the proposed certificate. You can find information to complete the table using the UA course catalog or UAnalytics (Catalog and Schedule Dashboard> "Printable Course Descriptions by Department" On Demand Report; right side of screen). If the courses listed belong to a department that is not a signed party to this implementation request, upload the department head's permission to include the courses in the proposed certificate and information regarding accessibility to and frequency of offerings for the course(s). Upload letters of support/emails from department heads to the "Letter(s) of Support" field on the UAccess workflow form. Add rows to the table, as needed. **New course proposals must be submitted via UAccess**

Course Add forms following the procedures and deadlines detailed here.

Course prefix and number (include cross-listings)	Units	Title	Pre-requisites	Modes of Delivery (online, in-person, hybrid)	Campus and Location Offered	Dept signed party to proposal? (Yes/No)
CSC 110	4	Introduction to Computer Programming I	PPL 60+ or SAT I MSS 640+ or ACT MATH 26+ or (C or higher in CSC 101 or MATH 112) or one courses from MATH 113, 116, 120R, 122A, 122B, or 125. Test scores expire after 2 years.	Online, in-person	main	yes
CSC 483	3	Text Retrieval and Web Search	Major: COSC. CSC 345.	Online, in-person	main	yes
ISTA 130	4	Computational Thinking and Doing	College algebra recommended.	Online, in-person	main and azonline	n/a
ISTA 355	3	Introduction to Natural Language Processing	ISTA 130 or CS 110 or ECE 175 AND ISTA 131 or CS 120, or consent of prof.	Online, in-person	main	n/a
ISTA 455	4	Applied Natural Language Processing	LING 388, ISTA 355, LING 438,or consent of prof.	Online, in-person	main	n/a
ISTA 456	3	Text Retrieval and Web Search	ISTA 350 (Programming for Informatics Applications) and Math 215 (Linear Algebra) or equivalent	Online, in-person	main	n/a
LING 201	3	Introduction to Linguistics		Online, in-person	main	yes
LING 388	3	Language and Computers	LING 201 or equivalent programming background.	Online, in-person	main	yes
LING 438	3	Computational Linguistics	LING 388 or a course in one of the following: formal languages, syntax, data structures, or compilers.	Online, in-person	main	yes

LING/ISTA/CSC 439	3	Statistical Natural Language Processing	LING 388, LING 438	Online, in-person	main	n/a
LING 478/ SLHS 478	3	Speech Technology	Coursework in phonetics (LING 314 or LING 515 or SPH 267 or SLHS 267) or a background in programming (such as a 100 or 200 level course from the Computer Science Department).	Online, in-person	main	yes

VI. CONTACTS AND ADMINISTRATION

UNDERGRADUATE (delete if n/a)

a. List the name and contact information for the primary point of contact for the certificate:

Catherine Brooks, Director, iSchool, cfbrooks@email.arizona.edu

Amy C. Kimme Hea, Associate Dean, Academic Affairs and Student Success, College of Social and Behavioral Sciences kimmehea@arizona.edu

b. List the name and contact information for the person or persons who will serve in the role of Director of Undergraduate Studies (DUS) for the certificate (this is not always the same as the DUS for affiliated programs or head of the managing academic unit.):

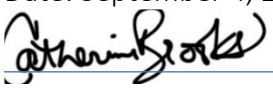
Diana Daly, Director of Undergraduate Studies, didaly@arizona.edu

c. If known, list the members of the certificate oversight committee for this certificate. Note: undergraduate certificate oversight committees shall consist of a minimum of 3 members, 2 of which are faculty and at least one of the 2 is participating faculty in the certificate program. The oversight committee is responsible for 1) qualifications of participating faculty, 2) coordination of admissions recommendations with the Office of Admissions, and 3) curricular changes:

VII. REQUIRED SIGNATURES

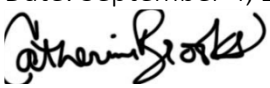
Program Director/Main Proposer (print name and title):
Catherine F. Brooks, Director, iSchool

Program Director/Main Proposer signature:
Date: September 4, 2021



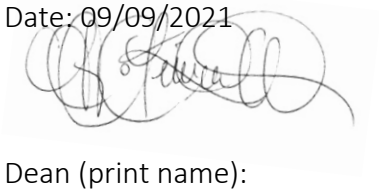
Department Head (print name and title):
Catherine F. Brooks, Director, iSchool

Department Head's signature:
Date: September 4, 2021



Associate/Assistant Dean (print name): Amy C. Kimme Hea

Associate/Assistant Dean's signature:
Date: 09/09/2021



Dean (print name):

Dean's signature:
Date:

For use by Curricular Affairs (Undergraduate):

Committee	Approval date
APS	
Undergraduate Council	
Undergraduate College Academic Administrators Council	

For use by Curricular Affairs (Graduate):

Committee	Approval date
GPERC	
Graduate College Academic Administrators Council	

THE UNIVERSITY OF ARIZONA®

BUDGET PROJECTION FORM

Name of Proposed Program or Unit: Natural Language Processing Certificate

	Projected		
Budget Contact Person:	**1st Year** 2021 - 2022	**2nd Year** 2022 - 2023	**3rd Year** 2023 - 2024
METRICS			
Net increase in annual college enrollment UG			
Net increase in college SCH UG			
Net increase in annual college enrollment Grad	5	10	30
Net increase in college SCH Grad	36	72	216
Number of enrollments being charged a Program Fee			
New Sponsored Activity (MTDC)			
Number of Faculty FTE			
FUNDING SOURCES			
Continuing Sources			
UG RCM Revenue (net of cost allocation)			
Grad RCM Revenue (net of cost allocation)			
Program Fee RCM Revenue (net of cost allocation)			
F and A Revenues (net of cost allocations)			
UA Online Revenues	12,420	24,840	74,520
Distance Learning Revenues			
Reallocation from existing College funds (attach description)			
Other Items (attach description)			
Total Continuing	**$ 12,420**	**$ 24,840**	**$ 74,520**
One-time Sources			
College fund balances			
Institutional Strategic Investment			
Gift Funding			
Other Items (attach description)			
Total One-time	**$ -**	**$ -**	**$ -**
TOTAL SOURCES	**$ 12,420**	**$ 24,840**	**$ 74,520**
EXPENDITURE ITEMS			
Continuing Expenditures			
Faculty			
Other Personnel			
Employee Related Expense			
Graduate Assistantships			
Other Graduate Aid			
Operations (materials, supplies, phones, etc.)			
Additional Space Cost			
Other Items (attach description)			
Total Continuing	**$ -**	**$ -**	**$ -**
One-time Expenditures			
Construction or Renovation			
Start-up Equipment			
Replace Equipment			
Library Resources			
Other Items (attach description)			
Total One-time	**$ -**	**$ -**	**$ -**
TOTAL EXPENDITURES	**$ -**	**$ -**	**$ -**
Net Projected Fiscal Effect	**$ 12,420**	**$ 24,840**	**$ 74,520**

Undergraduate Certificate Peer Comparison Chart- Select two peers for completing the comparison chart from (in order of priority) ABOR-approved institutions, AAU members, and/or other relevant institutions recognized in the field. The comparison chart will be used to identify typically required coursework, themes, and experiences for certificate programs within the discipline. The comparison programs are not required to have the same certificate name as the proposed UA program. Information for the proposed UA program must be consistent throughout the proposal documents. Delete EXAMPLE columns once ready to submit/upload.

Certificate name, institution	**Proposed UA Program:**	**Peer 1:** **University of Utah Computational Linguistics Certificate**	**Peer 2:** **San Jose State University Certificate in Computational Linguistics**
Current# of enrolled students		Roughly 10, the program just began in 2020.	Approximately 15 per year.
Certificate program description	The 12-credit hour Natural Language Processing (NLP) Certificate will provide undergraduate students the confidence and training they need in natural language processing - teaching computers to use language by extracting knowledge from text, and then using that knowledge in meaningful ways. The certificate will signal to employers that students have dedicated the time and energy necessary to develop the skills and confidence for working from these types of data. The Certificate will service a diverse student population, training both 1) technically-minded students as well as 2) less technically-minded students in the basic skills necessary for gathering insights from	From: https://linguistics.utah.edu/certificates-and-programs/comp-ling.php This undergraduate certificate is designed to help students acquire the knowledge and skills necessary to pursue a career path in an area of technology known alternatively as Computational Linguistics and Natural Language Processing (NLP). This is the science behind machine translation, text-to-speech, speech recognition, and many other important applications.	From: https://catalog.sjsu.edu/preview_program.php?catoid=2&poid=563&returnto=96 The Certificate in Computational Linguistics, offered by the Department of Linguistics and Language Development, is an 18 unit program that provides a basic education and a certain amount of practical training in the interdisciplinary field of computational linguistics. It was designed to meet the needs of individuals who desire formal course preparation as language analysts in the environment of human language interfaces in software development.

	NLP data. The Certificate will require students to complete a set of choices among the core courses while also allowing students to choose at least one elective course.		
Target careers	Artificial Intelligence Engineer Computational Linguist Data Associate Data Analyst Data Architect Data Engineer Data Scientist Language Engineer Machine Learning Engineer Machine Learning Scientist NLP Engineer NLP Scientist Research Scientist	Jobs with Computational Linguistics or Natural Language Processing as part of the job or skills Computer programmers Software developers Machine learning and computer information research scientists	Language analysts Software developers
Minimum total units required	12	27	18
Minimum upper-division units required	9	18	15
Total transfer units that may apply to certificate	6	??	??
List any special requirements to declare/admission to this certificate (completion of specific coursework, minimum GPA, interview, application, etc.)	None	None	None.

Certificate requirements. List all certificate requirements including core and electives. Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions needed (house number limit, etc.).	**Core:** **Complete 3 courses (10 units - may be 9 units if utilizing transferred credit):** Either ISTA 130 (4 units) or CSC 110 (4 units) or LING 201 (3 units) or LING 408 (3 units) Either ISTA 355 (3 units) or Ling 388 (3 units) LING/ISTA/CSC 439 (3 units) **Electives: Complete at least 3 units from the following:** LING 408 (3 units) LING 438 (3 units) LING 478: (3 units) ISTA 131 (3 units) ISTA 455 (4 units) ISTA 456 (3 units) CSC 483 (3 units)	LING 1200: Intro to the Study of Language -OR- LING 1069: Bad Words and Taboo Terms CS 1410: Intro to Object-Oriented Programming [1] CS 2420: Intro to Algorithms & Data Structures CS 3100: Models of Computation[2] CS 3500: Software Practice LING 4010: Intro to Phonetics and Phonology -OR- LING 4020: Intro to Syntax -OR- LING 5030: Semantics -OR- LING 5190: Psycholinguistics LING 3300: Computers and Language -OR- CS 3505: Software Practice II CS 5340: Natural Language Processing LING 5300: Computational Linguistics	LING 101 - Introduction to Linguistics 3 unit(s) LING 115 - Corpus Linguistics 3 unit(s) LING 124 - Introduction to Speech Technology 3 unit(s) LING 165 - Introduction to Natural Language Processing 3 unit(s) Electives (6 units) CS 123A - Bioinformatics I 3 unit(s) CS 123B - Bioinformatics II 3 unit(s) CS 154 - Formal Languages and Computability 3 unit(s) CS 156 - Introduction to Artificial Intelligence 3 unit(s) LING 111 - Introduction to Linguistic Phonetics 3 unit(s) LING 112 - Introduction to Syntax 3 unit(s) LING 113 - Introduction to Phonology 3 unit(s) LING 161 - Psycholinguistics 3 unit(s) LING 166 - Sociolinguistics 3 unit(s) MATH 105 - Concepts in Mathematics, Probability, Statistics 3 unit(s) MATH 161A - Applied Probability and Statistics I 3 unit(s) MATH 161B - Applied Probability and Statistics II 3 unit(s) MATH 162 - Statistics for Bioinformatics 3 unit(s) MATH 163 - Probability Theory 3 unit(s) STAT 95 - Elementary Statistics 3 unit(s) (B4) STAT 115 - Intermediate Statistics 3 unit(s)

Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	No	No	No
Additional requirements (provide description)	None	None	Demonstrated competence with a programming language such as Java, C/C++, and Python. This requirement is to be satisfied by the time you complete the certificate program rather than before you begin the program. Students typically fulfill the requirement by submitting a final project in a course (e.g. LING 165) that involves a substantial amount of coding.

1. **How does the proposed program align with peer programs? Briefly summarize the similarities between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.**

   This program is similar to other programs in it's focus on Natural Language Processing as an analytical tool for drawing conclusions from textual data sets. That is, the overall purpose of this kind of certificate is to enhance students' interest in the kinds of findings they can draw from data collection processes that are speech/text/language based.

2. **How does the proposed program stand out or differ from peer programs? Briefly summarize the differences between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.**

   Most programs seem to blend training in both natural language data processing and computational linguistics, or considerations of how computers can be trained to manage linguistic data. This program for the University of Arizona (UAZ) is similar in it's focus on both, but is distinct in the emphasis most primarily on natural language processing as a data science. We maintain this emphasis given the importance of data processing in society generally, and the centrality of data science training in our UAZ iSchool specifically.

3. **How do these differences make this program more applicable to the target student population and/or a better fit for the University of Arizona?**

   With a large and interdisciplinary iSchool, UAZ is distinct among peers in Arizona and also compared to the peers referenced above in this comparison chart. UAZ's iSchool is the only one in the state, that is. There is no iSchool in Utah, and the program referenced above at California State University, San Jose, is not housed in its iSchool. This program as it's written, with the emphasis on natural language processing as a data science, is the right fit for Arizona and for it's only iSchool.

THE UNIVERSITY OF ARIZONA

DEPARTMENT
LINGUISTICS

College of Social & Behavioral Science
1103 E. University Blvd
PO Box 210025
Tucson AZ 85721-0025

Tel: 520-621-6897
Fax: 520-626-9017

http://linguistics.arizona.edu

January 15, 2021

Provost's Office
University of Arizona

To Whom It May Concern:

This memo is to state the support of the Department of Linguistics for the proposed new undergraduate certificate in NLP (Natural Language Processing). We have developed this proposal in collaboration with the School of Information, and we look forward to teaching students in the certificate program together. A vote of the faculty of the Department of Linguistics was taken, and the faculty voted in favor of developing the certificate.

Sincerely,

Natasha Warner
Professor and Department Head
Department of Linguistics

David Lowenthal
Department of Computer Science

THE UNIVERSITY OF ARIZONA
TUCSON ARIZONA

Gould-Simpson Building
Tucson, Arizona 85721-0077
dkl@cs.arizona.edu
(520) 626-8282

January 28, 2021

To: Curricular Affairs, University of Arizona

Dear Curricular Affairs:

Computer Science supports the NLP certificate and will allow students in classes that count towards the certificate (CSC 110 and CSC 483) when possible. We will also let our students know about the opportunity to pursue the certificate.

Sincerely,

David Lowenthal

David Lowenthal
Professor and Interim Head