# http://www.ric.edu/webcommunications/images/SealWithText_Small_Black.pngUNDERGRADUATE CURRICULUM COMMITTEE (UCC)PROPOSAL FORM

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| A.1. [Course or program](#Proposal) | **CSCI 443** **Natural Language Processing** |  |
|  |  |
| A. 1b. Academic unit | **School of Business**  |  |
| A.2. [Proposal type](#type) | **Course: creation**  |  |
| A.3. [Originator](#Originator) | **Timothy Henry** | [Home department](#home_dept) | **Computer Science and Information Systems** |
| A.4. [Context and Rationale](#Rationale) Must include additional information listed in smart tip for all [new programs](#type). If **online** course or program, you need to explain what mode(s) you plan to use and why you need that specific delivery.  | Natural language processing (NLP) is one of the main uses of artificial intelligence and machine learning. CSCI 443 will provide students with in-depth experience in analyzing human language and semantic recognition. Students are then prepared to develop and evaluate NLP models used in many business applications, such as chatbots, conversational agents, search engines, speech recognition engines and speech-to-text. NLP helps students improve their communication and language skills by studying the intricacies of human language. This knowledge is valuable not only in NLP applications but also in effective written and spoken communication.Proficiency in NLP is increasingly in demand across various industries, including technology, healthcare, finance, and marketing. Understanding NLP opens a wide range of career opportunities in roles related to data analysis, machine learning, and AI. NLP teaches students problem-solving skills. It involves breaking down complex language-related challenges into manageable tasks, which is a valuable skill in many domains beyond NLP. As AI becomes increasingly integrated into society, understanding NLP is crucial for AI literacy. It allows students to grasp the capabilities and limitations of AI systems and make informed decisions related to AI technologies. Knowledge of NLP can inspire innovation. Students who understand NLP can develop creative solutions for automating language-related tasks, leading to new applications and products. |
| A.5. [Student impact](#student_impact)Must include to explain why this change is being made? | This course will be taken primarily by AI majors, but it can also serve as a very useful elective for CS and Data Science majors. |
| A.6. [Impact on other programs](#impact)  | Since this could serve as an elective for CS majors, that may reduce the number of students taking other 300- or 400-level CSCI elective courses. |
| A.7. [Resource impact](#Resource) | [*Faculty PT & FT*](#faculty):  | Existing CSCI faculty and/or adjunct faculty will teach the courses. Depending on the growth of the new AI Program, additional faculty and adjuncts may be needed. |
| [*Library*:](#library) | None |
| *Technology (for in person delivery)* | None. Courses will use existing classrooms and/or computer labs. (hence 25 cap) |
| *Technology: (for online delivery. Must be RIC supported)* | None |
| [*Facilities*](#facilities): | None. Courses will use existing classrooms and/or computer labs. |
| A.8. [Semester effective](#Semester_effective) | **Fall 2024** | A.9. [Rationale if sooner than next Fall](#Semester_effective) | **N/A** |
| A.10. INSTRUCTIONS FOR CATALOG COPY: Use the Word copy versions of the catalog sections found on the UCC Forms and Information page. Cut and paste into a single file **ALL the relevant pages from the college catalog that need to be changed.** Use tracked changes feature to show how the catalog will be revised as you type in the revisions. If totally new copy, indicate where it should go in the catalog. If making related proposals a single catalog copy that includes all changes is preferred. Send catalog copy as a separate single Word file along with this form. |
| A.11. List here (with the relevant URLs), any RIC website pages that will need to be updated (to which your department does not have access) if this proposal is approved, with an explanation as to what needs to be revised: |
| A. 12 **Check to see if your proposal will impact any of our** [**transfer** **agreements,**](file:///Users/SAbbotson/Documents/Curriculum/ManualandWebsite/transfer%20agreements) **and if it does explain in what way. Please indicate clearly what will need to be updated, including any changes in prefix numbers/titles for TES. N/A** |
| A. 13 Check the section that lists “Possible NECHE considerations” on the UCC Forms and Information page and if any apply, indicate what that might be here and contact Institutional Research for further guidance. N/A |

**C.** [**NEW OR REVISED COURSES**](#delete_if) **THAT ARE DESIGNATED AS HYBRID**

|  |   | New |
| --- | --- | --- |
| C.1. [Course prefix and number](#cours_title)  |  | **CSCI 443** |
| C.2. Cross listing number if any |  | **N/A** |
| C.3. [Course title](#title)  |  | **Natural Language Processing** |
| C.4. [Course description](#description)  |  | **Students explore human language and translate into a form for machine learning models. Students gain expertise in text analysis, sentiment analysis, chatbots, and more.** |
| C.5. [Prerequisite(s)](#prereqs) |  | **CSCI 428** |
| C.6. [Offered](#Offered) please read the screen tips to do this correctly, alternate years needs to be assigned odd/even, and a specific semester. |  | **Fall** |
| C.7. [Contact hours](#contacthours)  |  | **4** |
| C.8. [Credit hours](#credits) |  | **4** |
| C.9. [Justify differences if any](#differences) | N/A |

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| C.10. [Grading system](#grading)  |  | **Letter grade** |
| C.11. a. [Type of cours](#instr_methods)e  |  | **Lecture | Laboratory**  |
| C.11.b Instruction mode with percentage |  | **Hybrid:****51% in-person****49% online** Course will be offered one day a week in-person along with an in-person final project |
| Reminder: Instructors are responsible for ensuring their course meets accessibility standards and provides accommodations identified by Disability Services (find links).  |
| C.11.c. For online components only: How will students engage with the content  |  |  **Lectures (recorded) | Course readings | Videos or other recordings | Practice and lab activities | Online discussion boards**  |
| C.11.d. How will students engage with other students  |  | **In-class discussions | Class activities | Online discussion boards | Team/group projects** |
| C.12. CATEGORIES 12. a. [How](#required) to be used |  | **Restricted elective for major** |
|  12 b. Is this an Honors  course? |  | **NO** |
|  12. c. [General Education](#ge) N.B. Connections must include at least 50% Standard Classroom instruction. |  | **NO**  |
|  12. d. Writing in the  Discipline (WID) |  | **NO** |
| C.13. [How will student performance be evaluated?](#performance)  |  | **Exams | Class Work | Quizzes | Projects | Discussion board**  |
| C.14 [Recommended class-size](#class_size) |  | **25 (computer lab)** |
| C.15. [Redundancy statement](#competing) |  |  |
| C. 16. Other changes, if any |  |

| C.17**.** [**Course learning outcomes**](#outcomes)**: List each one in a separate row** | [**Professional Org.Standard(s)**](#standards)**, if relevant** | [**How will each outcome be measured?**](#measured) |
| --- | --- | --- |
| **Understand the fundamental concepts and techniques of NLP.** This includes topics such as text representation, machine learning for NLP, word embeddings, neural language models, and common NLP tasks such as classification, sentiment analysis, machine translation, and question answering. |  | Homework, projects, in-class assignments, quizzes and exams. |
| Implement language models and algorithms and apply them to analyze and generate text, incorporating techniques like part-of-speech tagging, tokenization, stemming, stop-word removal, and n-grams. |  | Homework, projects, and labs. |
| **Apply NLP techniques to solve real-world problems.** Students will be able to design, test, and implement NLP systems using sentiment analysis, named entity recognition, and text classification for a variety of applications, such as social media analysis, customer service, and healthcare. |  | Homework, projects, in-class assignments, course project. |
| **Critically evaluate NLP research and systems.** Students will be able to identify the strengths and weaknesses of different NLP approaches and assess the performance of NLP systems. |  | Written homework, in-class assignments, and exams. |
| **Communicate effectively about NLP.** Students will be able to write and speak clearly about NLP concepts and systems, both to technical and non-technical audiences. |  | Written homework, in-class assignments, and class presentations. |

| C.18. [**Topical outline**](#outline)**:**  |
| --- |
| **Week 1: Introduction to NLP, motivations, and applications*** What is NLP and why is NLP important?
* Key challenges in processing human language
* Applications of NLP
* Overview of the NLP pipeline

**Week 2: Text representation and preprocessing*** Tokenization and stemming
* Stop words removal
* Part-of-speech tagging

**Week 3: Language Models*** n-grams and probability models
* Hidden Markov Models (HMMs)
* Statistical Language Models

**Week 4: Syntax and Parsing*** Context-free grammars and parsing techniques
* Dependency parsing
* Parsing algorithms (CKY, Earley)

**Week 5: Information Extraction*** Named Entity Recognition (NER)
* Relation extraction
* Coreference resolution

**Week 6: Word Embeddings*** Word2Vec and GloVe
* Word similarity and analogy
* Embedding evaluation

**Week 7: Sequence-to-Sequence Models*** Introduction to Recurrent Neural Networks (RNNs)
* Encoder-Decoder architecture
* Applications in machine translation and summarization

**Week 8: Attention Mechanisms*** Self-attention mechanisms
* Transformer architecture
* BERT and its variants

**Week 9: Sentiment Analysis and Text Classification*** Sentiment analysis techniques
* Text classification with CNNs and LSTMs
* Transfer learning for text classification

**Week 10: Machine Translation*** Neural machine translation
* Sequence-to-sequence models for translation
* Evaluation metrics for machine translation

**Week 11: Named Entity Recognition and Part-of-Speech Tagging*** Detailed study of NER and POS tagging techniques
* Hands-on implementation

**Week 12: Chatbots and Conversational Agents*** Introduction to chatbot architectures
* Building conversational agents using frameworks like Dialogflow or Rasa

**Week 13: Question Answering and Document Retrieval*** QA systems and models like BERT-QA
* Document retrieval using Elasticsearch

**Week 14: Speech Recognition and Speech-to-Text*** Introduction to ASR and TTS systems
* Speech data processing and conversion to text

**Week 15: NLP for Specific Domains*** NLP for Social Media
* NLP for Healthcare
* NLP for Other Domains
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**G. Signatures**

* **Changes that affect General Education in any way MUST be approved by ALL Deans and COGE Chair**.
* Changes that directly impact more than one department/program MUST have the signatures of all relevant department chairs, program directors, and their relevant dean (e.g. when creating/revising a program using courses from other departments/programs). Check UCC manual 4.2 for further guidelines on whether the signatures need to be approval or acknowledgement.
* Proposals that do not have appropriate approval signatures will not be considered.
* Type in name of person signing and their position/affiliation.
* Send electronic files of this proposal and accompanying catalog copy to curriculum@ric.edu to the current Chair of UCC. Check UCC website for due dates. **Do NOT convert to a .pdf.**

##### G.1. Approvals: required from programs/departments/deans who originate the proposal. THESE may include multiple departments, e.g., for joint/interdisciplinary proposals.

| Name | Position/affiliation | [Signature](#_Signature" \o "Insert electronic signature, if available, in this column) | Date |
| --- | --- | --- | --- |
| Suzanne Mello-Stark | Chair of Computer Science and Information Systems | \*approved by email | 2/23/24 |
| Marianne Raimondo | Dean of School of Business | \*approved by email | 2/23/24 |

##### G.2. [Acknowledgements](#acknowledge): REQUIRED from OTHER PROGRAMS/DEPARTMENTS (and their relevant deans if not already included above) that are IMPACTED BY THE PROPOSAL. SIGNATURE DOES NOT INDICATE APPROVAL, ONLY AWARENESS THAT THE PROPOSAL IS BEING SUBMITTED. CONCERNS SHOULD BE BROUGHT TO THE UCC COMMITTEE MEETING FOR DISCUSSION; all faculty are welcome to attend.