# 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 444** **Computer Vision** |  |
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| 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.  | Image processing and computer vision (IPCV) is one of the main uses of artificial intelligence and machine learning. CSCI 444 will provide students with in-depth experience in the workflow needed for image processing and generation. IPCV is an interdisciplinary field that is having a profound impact on society, and it serves as foundational pillars for numerous industries. Images and videos play an increasingly vital role in various domains such as healthcare, autonomous systems, robotics, and manufacturing. IPCV requires a broad set of technical skills, including programming, mathematical modeling, and machine learning. This course will equip students with essential skills that are not only valuable in their careers but also transferrable to a wide range of industries. Understanding the ethical implications of IPCV is crucial to safe and successful implementation in a business environment. This course will educate students on responsible AI use, privacy concerns, and the potential societal impact of these technologies. |
| 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 444** |
| C.2. Cross listing number if any |  |  |
| C.3. [Course title](#title)  |  | **Computer Vision** |
| C.4. [Course description](#description)  |  | **Students are introduced image processing concepts and learn to manipulate and analyze digital images, extract features from images, and use machine learning to classify and detect objects in images.** |
| 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. |  | **Spring** |
| C.7. [Contact hours](#contacthours)  |  | **4** |
| C.8. [Credit hours](#credits) |  | **4** |
| C.9. [Justify differences if any](#differences) |  |

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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 discussions**  |
| 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) |  | **No** |
| 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) |
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| Understand the fundamental concepts and algorithms of image processing and computer vision. Includes topics such as image formation, image enhancement, image segmentation, feature extraction, and object recognition. |  | Homework, projects, labs, and exams. |
| Apply image processing techniques to enhance, transform, and manipulate digital images using appropriate software tools. |  | Homework, projects, and labs. |
| Implement computer vision algorithms to perform tasks such as object detection and recognition, optical character recognition (OCR), and motion tracking. |  | Homework, projects, and labs. |
| Analyze the results of image processing operations and computer vision algorithms, interpreting their impact on image quality and information extraction. |  | Written homework, projects, presentations, and exams. |
| Evaluate the strengths and weaknesses of various image processing and computer vision techniques for specific problem domains. |  | Homework, projects, in-class assignments, presentations, and exams. |

| C.18. [**Topical outline**](#outline)**:** |
| --- |
| **Week 1: Introduction to Image Processing*** Understanding the importance and applications of image processing.
* Digital image fundamentals: pixels, resolution, color models.
* Image representation and formats.

**Week 2: Image Enhancement*** Histogram equalization for image enhancement.
* Contrast stretching, compression, and equalization.
* Spatial domain techniques: smoothing and sharpening.

**Week 3: Image Filtering and Convolution*** Convolution operations and kernel design.
* Gaussian and median filtering.
* Edge detection: Sobel, Canny, and Laplacian operators.

**Week 4: Image Segmentation*** Thresholding techniques for binary image segmentation.
* Region-based segmentation.
* Contour-based segmentation and feature extraction.

**Week 5: Noise Reduction and Preprocessing*** Image noise types and reduction methods.
* Morphological image processing.
* Color image processing techniques.

**Week 6: Machine Learning in Vision*** Basics of machine learning: supervised and unsupervised learning.
* Feature extraction and selection in image data.
* Data preprocessing and normalization.

**Week 7: Image Classification*** Image classification concepts and challenges.
* Deep dive into Convolutional Neural Networks (CNNs).
* Building and training CNN models for image classification.

**Week 8: Object Detection and Localization*** Introduction to object detection techniques.
* YOLO (You Only Look Once) and SSD (Single Shot MultiBox Detector).
* Bounding box regression and localization.

**Week 9: Image Generation and Style Transfer*** Generative Adversarial Networks (GANs) for image generation.
* Neural Style Transfer and artistic image manipulation.
* Real-world applications of GANs and style transfer.
* Diffusion Networks

**Week 10: Transfer Learning and Fine-tuning*** Leveraging pre-trained models for image processing tasks.
* Fine-tuning and adapting models for specific applications.
* Case studies and practical examples.

**Week 11: Evaluation and Performance Metrics*** Precision, recall, F1-score, and accuracy.
* Confusion matrices and ROC curves for classification.
* Cross-validation and model selection.

**Week 12: Advanced Topics in Computer Vision*** 3D reconstruction and depth estimation.
* Semantic segmentation and object instance segmentation.
* Cutting-edge advancements and research trends in computer vision.

**Week 13: Project Development - Part 1*** Students choose a project topic and form groups.
* Guidance on project proposal development.

**Week 14: Project Development - Part 2*** Hands-on project work under the supervision of the instructor.
* Milestone assessments and feedback.

**Week 15: Project Presentations and Course Conclusion*** Final project presentations and demonstrations.
* Course review, key takeaways, and future directions in image processing and machine learning.
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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.

| Name | Position/affiliation | [Signature](#Signature_2) | Date |
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