Course Change Request

New Course Proposal

Date Submitted: 12/11/18 1:40 pm

Viewing: CDS 468 : Image Operators and Processing

Last edit: 12/11/18 1:40 pm

Changes proposed by: blaisten

Are you completing this form on someone else's behalf?

No

Effective Term:	Fall 2019		
Subject Code:	CDS - Computational and Data Sciences	**Course Number:**	468
Bundled Courses:			
Is this course replacing another course?	No		
Equivalent Courses:			
Catalog Title:	Image Operators and Processing		
Banner Title:	Image Operators and Processing		
Will section titles vary by semester?	No		
Credits:	3		
Schedule Type:	Lecture		
Hours of Lecture or Seminar per week:	3		
Repeatable:	May only be taken once for credit, limited to 2 attempts (N2)	**Max Allowable Credits:**	3
Default Grade Mode:	Undergraduate Regular		
Recommended Prerequisite(s):	CDS 230 or equivalent.		
Recommended Corequisite(s):			
Required Prerequisite(s) / Corequisite(s) (Updates only):			

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

In Workflow

1. **CDS Chair**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Undergraduate
5. Registrar-Courses
6. Banner

Approval Path

1. 12/11/18 5:16 pm Jason Kinser (jkinser): Approved for CDS Chair

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

An introductory examination of image mathematics, computational protocols, and applications. Topics include image operator notation, channel operators, informational operators, intensity operators, geometric operators, image transformations, frequency filtering, and image basis set expansions. This course will build the students' computational skill set as applied to visual data and create a library of image analysis scripts.

Justification:

Digital images are prominent in our modern society, supplanting text as a mode of communication. In 2008, over 30% of the web content was text, but that percentage has been following rapidly ever since.1 Other forms of digital media such as images and video have increased in preference. Almost 2 billion images are uploaded to websites every day.2 Thus, there is a need for data scientists to have capabilities in image understanding, image manipulation, extraction of information from images, and the ability to concisely report their protocols.

This course will assume that the student has very little experience in image analysis, and thus will begin with the basics of digital images and Python scripting of handling images. The course will then introduce an operator notation which concisely expresses images operators and in a manner that translates easily to Python scripts. Several types of operators will be presented as depicted in the syllabus starting with lecture 5. Students will describe the protocols through operator notation and create scripts that realize the protocols. By the end of the course, students will have a powerful library of image analysis scripts.

There are three main outcomes of this course. The first is an understanding of the fundamental image analysis techniques, the second is the ability to effectively describe protocols developed from the techniques, and the third is to be able to create simple Python scripts that replicate these protocols.

1. http://www.informationr.net/ir/20-3/paper682.html#.XAAvTuJRdPY_
2. https://www.quora.com/How-many-images-are-on-the-internet

Does this course cover material which crosses into another department? No

Learning Outcomes:

This course studies image operator mathematics, applying techniques to images in general emphasizing on image morphing, eigenimages, composite filtering, texture recognition, and image basis sets.

Attach Syllabus CDS468_syllabus.pdf

Additional Attachments

Staffing: Prof. Jason Kinser

Relationship to Existing Programs: None

Relationship to Existing Courses:

BENG 437 Medical Image Processing. This course studies image processing techniques specifically applied to medical images. The proposed CDS course differs by using image operator mathematics, applying techniques to non-medical images, and considering topics not covered in the BENG (image morphing, eigenimages, composite filtering, texture recognition, image basis sets).

GGS 410 Introduction to Hyperspectral Imaging. This course is concerned with a specific type of image and the applications of this hyperspectral images. The CDS course does not address hyperspectral images.

GGS 416 Satellite Image Analysis. This course is concerned with a specific type of image and the applications of this satellite images. The CDS course does not address satellite images.

Additional Comments:

Reviewer Comments

Key: 16260

Syllabus for CDS 468 Image Operators and Processing

Instructor: Jason Kinser

Texbook: Image Operators, J. Kinser, CRC Press, 2019

Subjects to be covered in 14 weeks:

1. Introduction. Python environment
2. Introduction to Image Operators.
3. Python scripting
4. Python vectors, matrices, images. (numpy, scipy, PILLOW)
5. Digital Images (resolution, format, compression, simple Ops)
6. Color (RGB, HSV, YCbCr; channel Ops)
7. EXAM 1
8. Geometric Transformations (shift, scale, rotate, dilation, coordinate transforms, polar, pincushion)
9. Image Morphing (warp, morph, Average face)
10. PCA
11. Eigenimages
12. Fourier theory
13. Fourier filtering
14. Fourier correlation, composite filtering
15. EXAM 2
16. Edges
17. Hough transform
18. Noise Reduction
19. Texture recognition
20. Gabor filtering
21. Shape representation
22. Basis Theory
23. PCNN
24. Final Prep