EEL 4930/5934 Computational Photography

1. Catalog Description – (3 credits) Fundamentals of computational photography, sensing, imaging and illumination.

2. Pre-requisites – MAC 2311, MAS 3114, PHY2048, Matlab image processing

3. Course Objectives – The student will learn the basics of computational photography, as it related to applications in computer vision, graphics and imaging. The student will understand how models of light from radiometry and optics can be used to understand scene information from images, build novel sensors and create new photographs. The student will understand the intersection between computing and light, a “camera culture” perspective of technology, professionally use sensors and cameras, and how to write code to create new photographs.

4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) – 1.5 hours of Engineering Science, 1.5 hours of Engineering Design

5. Relationship of course to program outcomes: Skills student will develop in this course (ABET only undergraduate courses) – EE3, a, c

6. Instructor - Dr. Sanjeev J. Koppal
   a. Office location: NEB 437
   b. Telephone: 352-392-8942
   c. E-mail address: sjkoppal@ece.ufl.edu
   d. Class Web site: https://www.ece.ufl.edu/users/koppal-sanjeev-j
   e. Office hours: Fridays, 1pm to 2pm

7. Teaching Assistant - None
   a. Office location:
   b. Telephone:
   c. E-mail address:
   d. Office hours:

8. Meeting Times and Location – Mon, Wed, Fri, 5th period (11:45am – 12:35pm)

9. Class/laboratory schedule - 3 class periods each week consisting of 50 minutes each

10. Material and Supply Fees - None

11. Textbooks and Software Required – Published research articles provided by instructor
   a. Title:
   b. Author:
   c. Publication date and edition:
   d. ISBN number:
12. Recommended Reading -
   a. Title: Robot Vision
   b. Author: B. K. P. Horn
   c. Publication date and edition: MIT Press 1986
   d. ISBN number: 0262081598

   a. Multiple View Geometry in Computer Vision
   b. Richard Hartley and Andrew Zisserman
   c. Cambridge
      ISBN number: 9780521540513

13. Course Outline (provide topics covered by week or by class period) –
   Week 1:
      Lec 1: History of cameras, sensors and light
      Lec 2: Camera culture and computational photography
      Lec 3: Pixels, Video and Art
   Week 2:
      Lec 4: Reflectance: basic principles
      Lec 5: Image processing
   Week 3:
      Lec 6: Reflectance: algorithms and measurements
      Lec 7: Camera calibration
      Lec 8: Image Warping and morphing
   Week 4:
      Lec 9: Lighting and shadows
      Lec 10: Programmable imaging
      Lec 11: Human head rendering
   Week 5:
      Lec 12: Interreflections
      Lec 13: Structured light
      Lec 14: Image pyramids, retargeting and fusing images
   Week 6:
      Lec 15: Reflection and refraction
      Lec 16: Superresolution
      Lec 17: Mosaicing images
   Week 7:
      Lec 18: Caustics of cameras and reflections
      Lec 19: Flutter shutter and temporal coding
   Week 8:
      Lec 20: Light polarization
      Lec 21: Camera arrays - 1
      Lec 22: Optical flow and motion
   Week 9:
      Lec 23: Basic principles of scattering
      Lec 24: Camera arrays - 2
      Lec 25: Spatial textures
Week 10:
   Lec 26: Advanced scattering in vision and graphics
   Lec 27: Catadioptric cameras
   Lec 28: Temporal textures

Week 11:
   Lec 29: Nov 3rd: Modeling fluids
   Lec 30: Nov 5th: Stereo with planar mirrors
   Lec 31: Nov 7th: Create digital mattes

Week 12:
   Lec 32: Optical processing with diffraction
   Lec 33: Deblurring
   Lec 34: HDR images

Week 13:
   Lec 35: Interference and angle sensitive pixels
   Lec 36: Polarization imaging
   Lec 37: Geometry from a single image

Week 14:
   Lec 38: High-speed flash photography

Week 15:
   Lec 39: Photo tourism
   Lec 40: Image-based rendering
   Lec 41: Transient imaging

Week 16:
   Lec 42: Presentations
   Lec 43: Presentations

14. Attendance and Expectations - Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

   Attendance and participation will form a significant portion of the grade. Presentations by students must be attended by other students. Failure to meet these requirements will result in that portion of the grade corresponding to participation to be docked.

   Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

15. Grading –
   Participation  20%
   Presentations  15%
   Midterm        30%
   Final          35%

16. Grading Scale –

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<th>Grade</th>
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<tr>
<td>A</td>
<td>90-100</td>
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<td>B</td>
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“A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better).” Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

“Undergraduate students, in order to graduate, must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better).” Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

17. Make-Up Exam Policy - If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

18. Honesty Policy – UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

19. Accommodation for Students with Disabilities – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide documentation to the student who must then provide this documentation to the course instructor when requesting accommodation.

20. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   - UF Counseling & Wellness Center, psychological and psychiatric services, 3190 Radio Rd, 392-1575, online: http://www.counseling.ufl.edu/cwc/Default.aspx,
   - Career Resource Center, Reitz Union, career and job search services, 392-1601.
   - University Police Department, 392-1111 or 911 for emergencies
21. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

22. Course Evaluation – Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at: https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at: https://evaluations.ufl.edu/results.