ECG782: MULTIDIMENSIONAL DIGITAL SIGNAL PROCESSING

COURSE INFORMATION

http://www.ee.unlv.edu/~b1morris/ecg782
OVERVIEW

- Course Syllabus
- Grading Explanation
- Software Note
Instructor
- Professor Brendan Morris
- Office: SEB 3216, Virtual meeting hours
- Email: brendan.morris@unlv.edu

Website
- http://www.ee.unlv.edu/~b1morris/ecg782/
- Has schedule, lectures, homework, etc.
- Bookmark it!
Required Textbook
- Digital Image Processing 3E, Gonzalez and Woods
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow 2E, Géron

Recommended References
- Computer Vision: Algorithms and Applications, Szeliski [online]
  - http://szeliski.org/Book/
Theory and applications of multidimensional (M-D) digital signal processing. M-D signals and systems. M-D z-transform. M-D DFT and FFT. Design and implementation of M-D FIR and IIR filters. Applications to image processing such as image enhancement and restoration. Advanced topics chosen according to class interests.

Emphasis will be on Image Processing, Computer Vision, and Deep Learning

Less on traditional signal processing
<table>
<thead>
<tr>
<th>Grade Component</th>
<th>Percentage</th>
<th>Due Date or Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>25%</td>
<td>W 05/12</td>
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<tr>
<td>Midterm</td>
<td>20%</td>
<td>TBD ~ Spring Break</td>
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<tr>
<td>Homework</td>
<td>15%</td>
<td>First half of class</td>
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<tr>
<td>Project</td>
<td>25%</td>
<td>Second half of class</td>
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<tr>
<td>Presentation</td>
<td>10%</td>
<td>Paper presentation</td>
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<tr>
<td>Participation</td>
<td>5%</td>
<td>In-Class</td>
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GRADING II

- **Project**
  - Each student will do a computer vision project
    - Programming using OpenCV, Matlab, Keras/TensorFlow (or another language of choice)
  - Grading based on presentation and report (IEEE conference style)

- **Homework**
  - Approximately 5 assignments + paper reading
  - Will be due via Webcampus and no late assignments accepted
  - Permitted to work with and help one another
    - All assignments must be turned in individually (no copying)
  - Must use Latex for formatting [linux, win]
TOPICS

- Imaging properties and mathematics
- Spatial image filtering
- Frequency domain processing
- Morphology
- Feature Detection and Representation
- Segmentation

- Motion estimation
- Object detection
- Object recognition
- Tracking
- Introduction to deep learning
- Convolutional neural networks
Traditionally taught using Matlab/OpenCV
- Suggest using Python in place of Matlab due to license difficulty → probably better in the long run

OpenCV
- Open source and cross platform (Python!) → standard in community for many years
- Can be tricky to get setup and familiar with initially
- Lots of documentation is online → be sure to match your version of OpenCV

Deep learning frameworks
- Popular choices are TensorFlow, Keras, PyTorch
- Due to platform variability, use of Docker or notebook (Jupyter, PyCharm, Colab) may be good choices

We will start with Matlab/OpenCV before transitioning
- Note: almost all CV and ML research using Linux making Window slightly more difficult