Programming assignment for 2812ICT

(worth 40% of the final mark)

Alan Liew

T2 2021

Important matters

- Major Programming assignment for 2812ICT
  - 40% of final mark
    - Mark distribution: project proposal (5 marks), final report with code (25 marks), presentation with Q&A (10 marks)
  - Compulsory
  - Individual project

- Submission:
  - By week 8, Sunday 19 Sep 2021:
    - Your project proposal.
  - By week 11, Sunday 10 Oct 2021:
    - A properly formatted report describing your project and findings
    - Your code
  - In week 12, during lab time:
    - A 5 minutes video presentation of your project + 3 minutes Q&A

Project proposal (5 marks)

- Maximum of 3 pages
- Submit by week 8 (Sunday, 19 Sep 2021) as a pdf document
- Include the following:
  - Title and author
  - Introduction: Problem you want to solve and why
  - Technical Approach: How do you propose to solve it?
  - Expected outcome/result
  - Milestones (dates and sub-goals)
  - References
- Note: your proposal should guide your final project

Project report (25 marks)

- Submitted in week 11 (Sunday, 10 October 2020)
- **Important: Use the template provided**
- Page length: maximum of 10 pages (including everything)
- Include the following:
  - Title and author
  - Abstract
  - Introduction
  - Previous work
  - Technical Approach
  - Experiments
  - Conclusions
  - References

Video presentation (10 marks)

- Online presentation on week 12 during lab time
- Short 5 mins video presentation
- Include the following in your video:
  - Problem Motivation/Description
  - Technical Approach
  - Results
  - Code Demo
- 5 minutes Q&A from assessors

Project Advice

- Make sure the project scope fits the course (very important)
- Constrain your problem so that it is achievable (very important)
- Think about the datasets you need
- You may need to learn stuffs outside of the course
- You can use functions from OpenCV in your code

At the end, you demonstrate understanding through the report, the video presentation, and your ability to answer questions in Q&A.

Project Scope

- It **must** be related to computer vision, and to some of the concepts covered in the course
- Suggestions for project direction
  - Replicate an interesting paper
  - Compare different methods
  - Use a new approach to an existing problem
  - Implement an interesting system
  - Original research

Marking Rubric

- Project proposal (5):
  - Idea well developed – logical, well planned and achievable (3)
  - Clarity and presentation (2)
- Final Report (25):
  - Idea clearly presented (5)
  - Technical approach & implementation effort well described(10)
  - Experiment quality and discussion (5)
  - Overall writing quality (5)
- Video Presentation (10):
  - Clarity (4)
  - Code demo (3)
  - Q&A (3)

Datasets

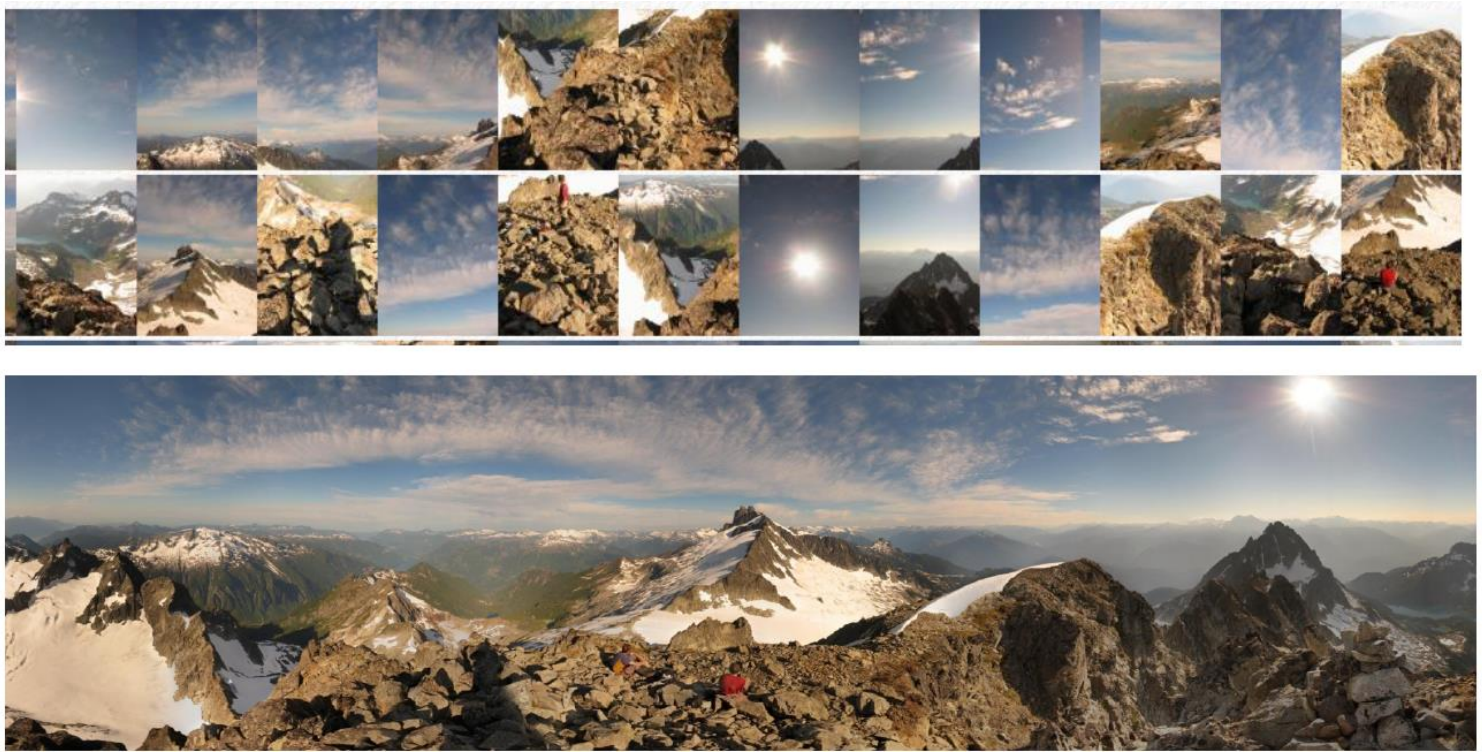
- Create your own dataset.
- Alternatively, some popular computer vision datasets are:
  - Meta Pointer: A large collection organized by CV Datasets.
  - Yet another Meta pointer
  - ImageNet: a large-scale image dataset for visual recognition organized by WordNet hierarchy
  - SUN Database: a benchmark for scene recognition and object detection with annotated scene categories and segmented objects
  - Places Database: a scene-centric database with 205 scene categories and 2.5 millions of labelled images
  - NYU Depth Dataset v2: a RGB-D dataset of segmented indoor scenes
  - Microsoft COCO: a new benchmark for image recognition, segmentation and captioning
  - Flickr100M: 100 million creative commons Flickr images
  - Labeled Faces in the Wild: a dataset of 13,000 labeled face photographs
  - Human Pose Dataset: a benchmark for articulated human pose estimation
  - YouTube Faces DB: a face video dataset for unconstrained face recognition in videos
  - UCF101: an action recognition data set of realistic action videos with 101 action categories
  - HMDB-51: a large human motion dataset of 51 action classes
  - ActivityNet: A large-scale video dataset for human activity understanding
  - Moments in Time: A dataset of one million 3-second video

Idea?

- Find an interesting vision paper and replicate it
  - CVPR: IEEE Conference on Computer Vision and Pattern Recognition
  - ICCV: International Conference on Computer Vision
  - ECCV: European Conference on Computer Vision
  - ICIP: International Conference on Image Processing
  - Beware: this could be very challenging! So you probably need to scale the problem down
- It can be in one of these:
  - Geometry – stereo vision, 3D reconstruction, depth recovery
  - Matching & modelling
  - Mid level processing
  - Recognition
- Example list of topics done in a CV course at University of Illinois here. Not all are relevant to our course but they give you some ideas of topic.

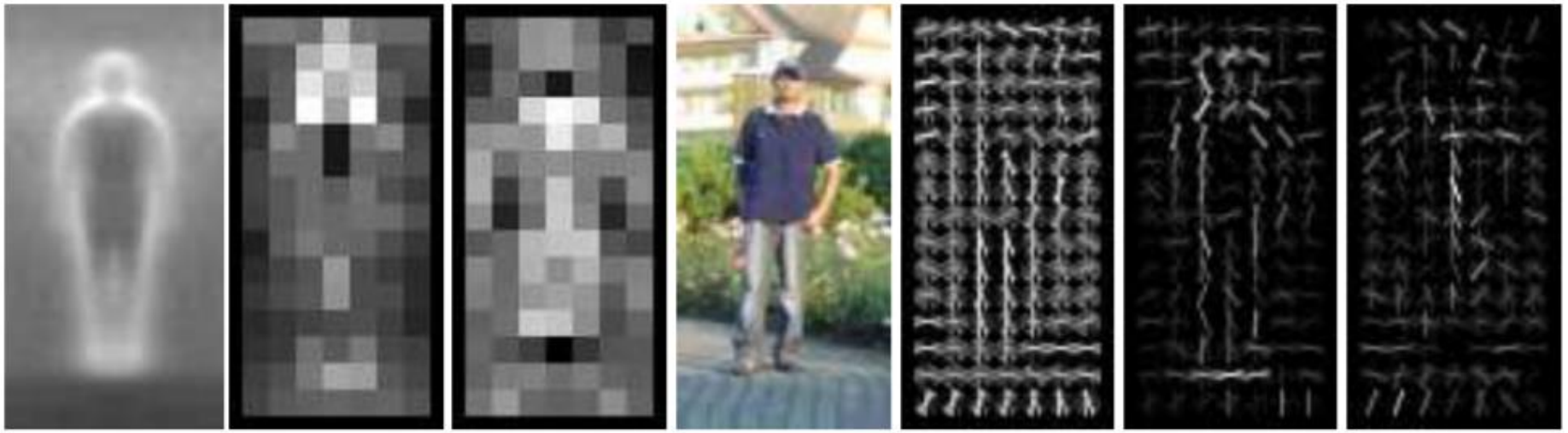
Examples

- Panorama Stitching
  - M. Brown and D. G. Lowe, Recognizing Panoramas, ICCV 2003



Examples

- Histograms of Oriented Gradients for Human Detection
  - N. Dalal, B. Triggs, “Histograms of Oriented Gradients for Human Detection”, CVPR2005
  - https://lear.inrialpes.fr/people/triggs/pubs/Dalal-cvpr05.pdf



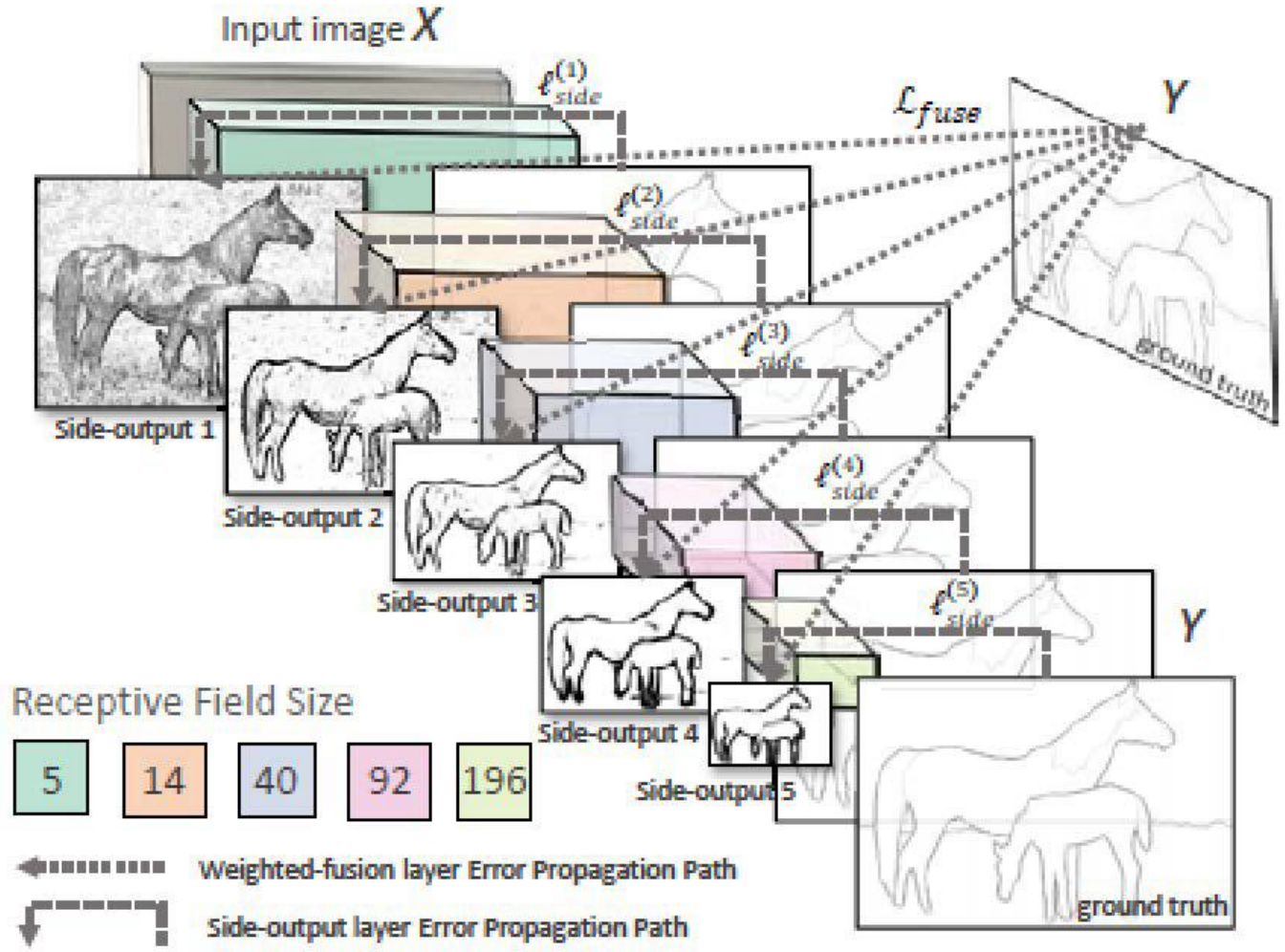
Examples

- Spatial Pyramid Matching for Recognizing Natural Scene Categories
  - S. Lazebnik, C. Schmid, J. Ponce, “Beyond Bags of Features: Spatial Pyramid Matching for Recognizing Natural Scene Categories”, CVPR2006 (https://ieeexplore.ieee.org/document/1641019/)
  - http://slazebni.cs.illinois.edu/slides/ima_poster.pdf

Figure 4. Retrieval from the Scene Category Database. The Query Images are on the Left, and the Eight Images Giving the Highest Values of the Spatial Pyramid Kernel (for $L = 2, M = 200$) are on the Right. The Actual Class of Incorrectly Retrieved Images is Listed Below Them

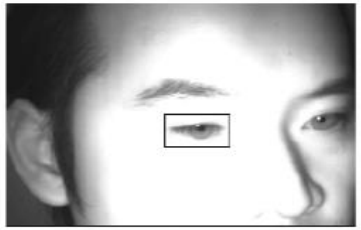
Examples

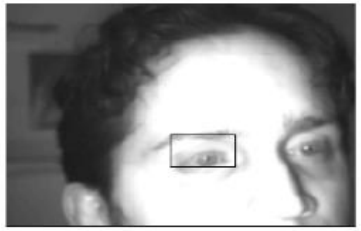
- Edge detection using deep learning
  - S. Xie, Z. Tu, “Holistically-Nested Edge Detection”, ICCV 2015
  - http://openaccess.thecvf.com/content_iccv_2015/papers/Xie_Holistically-Nested_Edge_Detection_ICCV_2015_paper.pdf

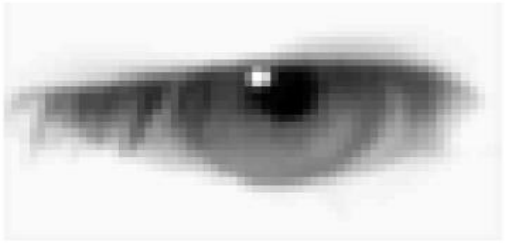


Examples

Human Gaze Tracking







Some previous year projects:

- Bird species identification
- Sign language recognition
- Facial expression recognition
- Cricket trainer
- Hand gesture recognition for HCI
- Avatar puppetry
- Playstation move wand tracking
- Exercise coach – posture scoring
- Panoramic image stitching
- Cloud shape imagining
- Plus many others…