Electronics Club

Computer Vision Roadmap

WEEK 1:

Intro to Python and its libraries

Basics of Python
Intro to Python 1
Intro to Python 2

numpy , pandas , matplotlib
python numpy tutorial

Explore this Kaggle notebook to learn about the libraries.
https://www.kaggle.com/code/chats351/introduction-to-numpy-pandas-and-matplotlib

Images and image processing

Color spaces, pixels, application of image processing

Understanding color spaces
https://www.geeksforgeeks.org/hsv-color-model-in-computer-graphics/

Image processing (overview)
https://www.youtube.com/watch?v=kSqxn6zGE0c

Some basic OpenCV commands can be explored under the basic section
https://docs.opencv.org/4.x/d7/da8/tutorial_table_of_content_imgproc.html

Fundamental openCV functions:
Exercises-1

Tinkering with OpenCV

Tinker here

Histograms

Check out these geek-for-geeks articles for basic insight on histograms
https://www.geeksforgeeks.org/histogram-equalization-in-digital-image-processing/
https://www.geeksforgeeks.org/histogram-of-an-image/?ref=lbp

Medium article on the same with OpenCV implementation
https://medium.com/@rndayala/image-histograms-in-opencv-40ee5969a3b7

WEEK 2:

Convolution

Image kernels and maths behind the processes

What is convolution? (intuitive)
https://youtu.be/KuXjwB4LzSA

An article to help you understand convolution and the concept of padding
https://www.allaboutcircuits.com/technical-articles/two-dimensional-convolution-in-image-processing/

Convolution explained visually:
https://setosa.io/ev/image-kernels/
https://programmathically.com/understanding-convolutional-filters-and-convolutional-kernels/

Filters and Denoising

Image filtering:
Image filtering
Medium article on image filters

Denoising:
Denoising methods
Medium article on commonly used image filters in OpenCV

(till ‘template matching’ should suffice for filters and blurs)

Overview | Image Processing I

Edge detection

Sobel filters, Scharr filters, Laplacian, Canny edge detection

Comparing different edge detection methods:
https://medium.com/@nikatsanka/comparing-edge-detection-methods-638a2919476e

Refer to these PDFs for more info on edge operators and canny detectors.
Edge: Operators
Edge: Canny

Reference to top up the PDFs (the playlist, till canny detector should suffice for edge detection)
Overview | Edge Detection

WEEK 3:

Morphological operations

Erosion and dilation
OpenCV: Eroding and Dilating

Refer to this PDF as well
Morphological Processing

OpenCV documentations
Arithmetic operations 1
Arithmetic operations 2

Perspective Transformations and homography Matrix

https://pyimagesearch.com/2014/08/25/4-point-opencv-getperspective-transform-example/

https://docs.opencv.org/4.x/d9/dab/tutorial_homography.html

Hough transforms

An article on the same
Complete guide on hough transforms

Refer to videos from 7 to 11
Overview | Edge Detection

PDF for reference
Hough Transforms

RANSAC

Intro to RANSAC
CS131 L07 RANSAC
Overview of RANSAC algo

Mediapipe Model by Google (not required to do it under week 1, feel free to do it after completing other weeks' resources)

Also, check out this mediapipe model, which comes in handy in many projects:
mediapipe for dummies

Use this video as your reference
https://youtu.be/01sAkU_NvOY?feature=shared

Further applications of mediapipe and some mini projects
https://learnopencv.com/introduction-to-mediapipe/

WEEK 4:

Neural Networks

First 4 videos of this 3b1b playlist
https://youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi&si=1YXoqA4v-zSkNzW5

All videos of weeks 1 and 2 of
https://www.coursera.org/learn/advanced-learning-algorithms on Coursera.

For practice, refer to this colab notebook.

Data_Classification.ipynb

You can look over these links for more insight about backpropagation

https://towardsdatascience.com/backpropagation-made-easy-e90a4d5ede55

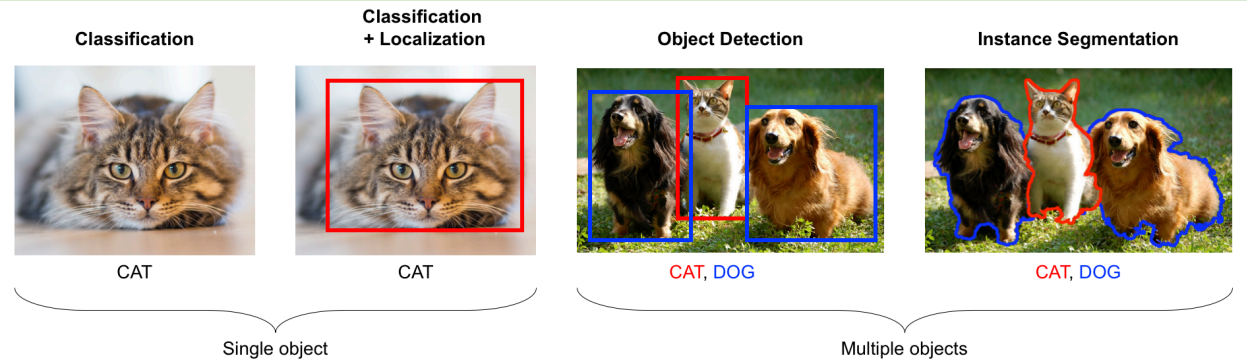
https://cs231n.stanford.edu/slides/2018/cs231n_2018_ds02.pdf

Deep Learning

1) Video 19 to 29 of the Deep Learning playlist by Deep Lizard:
https://youtube.com/playlist?list=PLZbbT5o_s2xq7LwI2y8_QtvuXZedL6tQU&si=k4Aa73BgSfZkilLU

2) https://www.youtube.com/watch?v=HGwBXDKFk9I

WEEK 5:



[Different CNN architectures for image classification]

[Semantic Segmentation vs Object Detection: Understanding the Differences]

[What Is Image Segmentation?]

Video 23 to 36:
https://youtube.com/playlist?list=PLkDaE6sCZn6Gl29AoE31iwdVwSG-KnDzF&si=IPpkI38MX0uUNBJo

YOLO

What is YOLO algorithm? | Deep Learning Tutorial 31 (Tensorflow, Keras & Python)

Object Detection using YOLO
Train Yolov8 object detection on a custom dataset | Step by step guide | Computer visi...

Image Segmentation using YOLO
Image segmentation with Yolov8 custom dataset | Computer vision tutorial

Colab notebook for implementation of YOLO:- [YOLOv3 in OpenCV]

[Detecting Potholes using TinyYOLO4]

[For more projects on YOLO]

Detectron2

329 - What is Detectron2? An introduction.

330 - Fine tuning Detectron2 for instance segmentation using custom data

Tutorial for using Detectron2 framework: Detectron2 Tutorial.ipynb