Electronics Club

Computer Vision Roadmap

WEEK 1: Getting comfortable with python and images

Day 1: "Wait... what's Python got to do with CV?"

Let's start from ground zero. Python is your weapon of choice. Think of it as the language your AI brain will speak.

Watch Basics of Python 👉
Intro to Python 1
Intro to Python 2

Day 2: "Whoa, what's NumPy ,Pandas and Matplotlib?"

Ever heard the phrase "data is power"? Today you'll meet the trio that makes data handling a breeze.

numpy , pandas , matplotlib
Python NumPy Tutorial for Beginners
Python Pandas Tutorial
Matplotlib Crash Course

Explore this Kaggle notebook to learn about the libraries.
Introduction to NumPy, Pandas and Matplotlib
You can also explore Official Documentations of given libraries here :
Numpy Documentation
Pandas Documentation
Matplotlib Documentation

Day 3: “Okay, let’s bring in images”

Let’s meet the pixels. Today’s the day you find out how computers *see*.

Read this article for understanding color spaces
https://www.geeksforgeeks.org/hsv-color-model-in-computer-graphics/

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

Day 4: “Let's meet OpenCV – your new BFF”

Here comes OpenCV, your computer vision toolbox. Want to flip, crop, resize, blur an image? OpenCV says, “I got you.”

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

Day 5: “What do histograms say about images?”

Think of histograms like image DNA — they show how colors/pixels are distributed.Here are some useful resources you should go through:

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

Day 6–7: Tinker Weekend

Take off your “student” hat and put on your “mad scientist” goggles 🧪. This weekend is yours. Break stuff. Build weird things
tinker this

WEEK 2: Dive into Filters and Edge Detection

Day 1: "So... what is Convolution?"

Don't worry, we're not throwing calculus at you. Just Think of it as Convolution = applying a filter to an image. That's it. It's everywhere in CV.

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/

Want to play with filters and see how they affect images live? .

Image Kernals

Day 2: Visualise It!

You're a visual learner, right? So are computers. Let's look at filters *visually*.
https://setosa.io/ev/image-kernels/
https://programmathically.com/understanding-convolutional-filters-and-convolutional-kernels/

Day 3–4: "Blurring, Sharpening, and everything between"

Filters are the heart of image beautification. Wanna blur a photo like you would on Snap? Or remove wrinkles from a face scan?Image filtering is here for you.

Image filtering:
image filtering
medium article on image filtering

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

(till 'template matching' should suffice for filters and blurs)

Overview on image processing

Mini Challenge(For better understanding**)**: Take a noisy image (you can add noise manually in NumPy). Try 3 denoising techniques — Gaussian, Median, and Bilateral. Compare the results.

Day 5–6: “Edge Detectors vs The World”

Now that you’ve cleaned and filtered your image, it’s time to find edges — the outlines of objects. This is where computer vision starts *seeing*.

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

Refer to these for more info on edge operators and canny detectors.

Sobel_derivatives
Canny

the playlist, till canny detector should suffice for edge detection

Edge Detection

Mini Task: Apply all 3 methods (Sobel, Laplacian, Canny) to the same image. Compare results. Which one’s cleanest? Which catches the most detail?

Day 7: “Let’s Practice”

You've crushed a full week of filters and edge detectors.let’s practice what you learned by running through a recap *with real code and visual demos*.

This Collab notebook covers grayscale, filters, blurs, edge detection — all in one place. Run and tweak the code to reinforce concepts.

OpenCV fundamentals

- Make a grid of images: original, grayscale, Gaussian blur, median blur, Canny, Sobel, etc.Label each one and keep it as a cheat sheet. You can do this using matplotlib`s subplot() in Python.

WEEK 3: Morphology, Image Math & Mediapipe Magic

Day 1–2: “Let’s morph images – erosion & dilation”

Time to clean up or enhance image structures! Morphological operations help highlight key features or remove unwanted noise — kinda like brushing up your image.

Erosion and dilation
OpenCV:Eroding and Dilating

Refer to this youtube video also

Morphological Transformations

Day 3: “Image Math Time!”

You’re now the calculator for pixels — time to add, subtract, and compare images mathematically

OpenCV documentations
Image Addition and Substraction
Bitwise Operation on Binary images

Day 4–5: “Draw lines with Hough Transform”

Now let’s detect shapes like lines and circles using **Hough Transform** — the tool behind lane detection in self-driving cars.

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

Day 6: “Let’s talk RANSAC”

RANSAC = “Random Sample Consensus” — a fancy term for finding reliable patterns in noisy data. Think of it like guessing where the best-fit line should go even if outliers exist

Here are some resources to go through:

Intro to RANSAC
CS131 L07 RANSAC
Overview of RANSAC algo

Day 7: “Let’s play with Mediapipe (Optional but 🔥 fun)”

Wanna detect body poses, face mesh, hand gestures — *real-time*? Google’s Mediapipe makes ir super easy.Perfect for interactive CV apps

Check out this mediapipe model, which comes in handy in many projects:

mediapipe for dummies

Use this video as your reference
https://www.youtube.com/watch?v=01sAkU_NvOY

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

WEEK 4: Neural Networks & Deep Learning Foundations

Day 1: “Perceptrons & the Birth of Neural Nets”

Today you’ll meet the perceptron—the basic building block of every neural network. Think of it as a single neuron.

First 4 videos of this 3b1b playlist
https://www.youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi

To know more about perceptrons you can refer this:

What is Perceptrons

Day 2: “Dive into Advanced Learning Algorithms”

Time to see neural nets in action on Coursera.

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

Day 3: “Hands-On: The Data_Classification Notebook”

Let’s code! Use the provided Colab notebook to train a simple network.

Data_Classification.ipynb

Day 4: “Deepen Your Backprop Understanding”

You can look over these links for more insight about backpropagation
https://ml-cheatsheet.readthedocs.io/en/latest/backpropagation.html

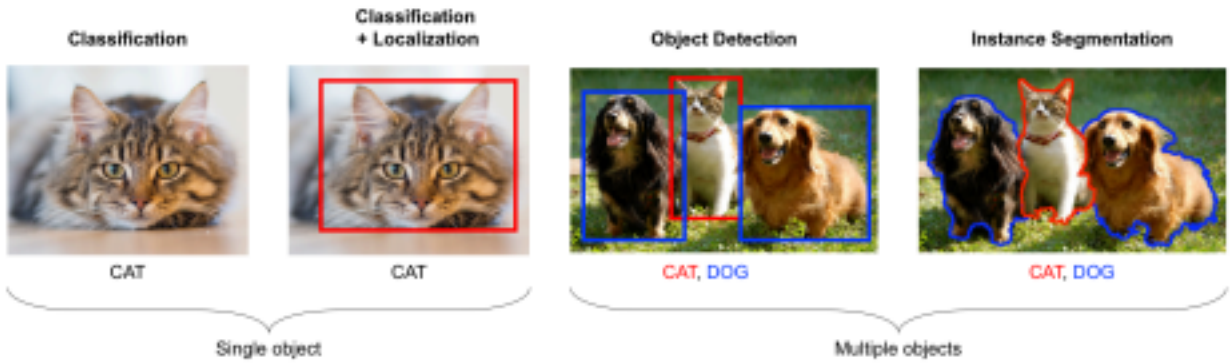
https://cs231n.stanford.edu/slides/2018/cs231n_2018_ds02.pdf

Day 5 ,6 & 7: “Into Deep learning”

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

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

WEEK 5: Convolutional Neural Networks & Image Segmentation



Different CNN architectures for image classification
Semantic Segmentation vs Object Detection: Understanding the Differences

What Is Image Segmentation?

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

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

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