

# **Self Learning Checklist for AI & Computer Vision**

## **(Beginner to Advanced)**



**IMPORTANT: This is the checklist not a 4 year study plan. Users must work around the curriculum and use what best works for them.**

**Make sure to learn hands-on skills with the learning resources and make fun projects along the way.**

## **Building Foundations (approx $\approx$ 3 months )**

### **Goal:**

Create strong foundations in:

1. MATH
2. PROGRAMMING
3. ML foundations(only conceptual)

## **Programming (Python Mastery)**

### **Topics:**

- Python basics
- OOP
- NumPy
- Pandas
- Matplotlib
- Basic algorithms
- Git & GitHub

### **Resources:**

- ❖ freeCodeCamp :

[Object Oriented Programming in Python \(Full Course\)](#)

[Git and GitHub for Beginners - Full Course](#)

[Scientific Computing with Python Certification](#)

[Learn Python - Full Course for Beginners \[Tutorial\]YouTube · freeCodeCamp.org11 Jul 2018](#)

[Python NumPy Tutorial for BeginnersYouTube · freeCodeCamp.org2.1M+ views · 6 years ago](#)

[Pandas & Python for Data Analysis by Example – Full Course ...YouTube · freeCodeCamp.org557.4K+ views · 2 years ago](#)

[Learn Matplotlib in 1 hour!](#)

- ❖ Corey Schafer
- ❖ Tech With Tim

## Tools:

- VS Code
- Jupyter Notebook
- GitHub

# Math for AI

## Topics:

- Linear Algebra (vectors, matrices)
- Calculus (derivatives, gradients)
- Probability & Statistics
- Eigenvalues
- Chain rule (VERY important for CNNs)

## Resources:

- Khan Academy
- 3Blue1Brown (Essence of Linear Algebra). Can

# Machine Learning Basics

## Topics:

- Supervised vs Unsupervised learning
- Loss functions
- Gradient Descent

- Overfitting
- Regularization

#### Course:

- Stanford-Andrew Ng ML Course
- StatQuest

#### Framework:

- Scikit-Learn
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## Deep Learning Foundations (3–6 Months)

Understand Neural Networks deeply.

### Neural Networks

#### Topics:

- Perceptron
- Activation functions (ReLU, Sigmoid)
- Backpropagation
- Optimization (Adam, SGD)
- Dropout
- Batch normalization

#### Tools:

- PyTorch
- TensorFlow

#### Resources:

- DeepLearning.AI
  - PyTorch Tutorials
  - TensorFlow
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# **Computer Vision Core (6–10 Months)**

Now we enter serious territory :

## **Image Processing Basics**

### **Topics:**

- Image representation
- RGB, Grayscale
- Convolution
- Filters
- Gaussian Blur
- Sobel Operator
- Canny Edge Detection
- Histogram Equalization

### **Tool:**

- OpenCV

### **Resource:**

- OpenCV
- Murtaza's Workshop

## **Convolutional Neural Networks (CNN)**

### **Topics:**

- Convolution layers
- Padding & Stride
- Pooling layers
- Feature maps
- Fully connected layers
- Transfer Learning
- ResNet
- VGG
- EfficientNet

## **Projects:**

- MNIST digit classifier
- CIFAR-10 image classifier
- Custom dataset classifier

## **Resources:**

- Stanford University CS231n
  - Aladdin Persson
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# **Object Detection (10–14 Months)**

Detects objects in real-time.

## **Concepts:**

- Bounding boxes
- IoU (Intersection over Union)
- Non-Max Suppression
- Anchor boxes

## **Models:**

- R-CNN
- Fast R-CNN
- Faster R-CNN
- YOLO (v5/v8)
- SSD

## **Tools:**

- Ultralytics YOLO
- PyTorch

## **Resource:**

- Ultralytics
- Roboflow

## **Projects:**

- Real-time face detector
  - Helmet detection
  - Traffic sign detector
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# **Image Segmentation (14–18 Months)**

Pixel-level classification.

## **Types:**

- Semantic Segmentation
- Instance Segmentation
- Panoptic Segmentation

## **Models:**

- U-Net
- Mask R-CNN
- DeepLabV3

## **Projects:**

- Medical image tumor segmentation
- Road segmentation for self-driving
- Satellite image land detection

# **Advanced Topics (Optional Elite Level)**

- Vision Transformers (ViT)
- GANs
- Diffusion Models
- Self-supervised learning
- Multi-modal AI (Vision + Language)
- Edge AI (Deploying on Raspberry Pi / Jetson Nano)



## Essential Tools Stack

Category	Tools
Coding	Python
Deep Learning	PyTorch
Vision	OpenCV
Data	NumPy, Pandas
Visualization	Matplotlib
Deployment	Docker
Experiment Tracking	Weights & Biases

## Final Portfolio Projects

To be considered advanced:

1. Real-time Object Detection System
2. Custom-trained Segmentation Model
3. Edge Device Deployment
4. Research paper reproduction

5. Kaggle competition

## Weekly Structure (Example)

- 5 days learning
- 2 days building
- 1 project per month
- 1 Kaggle competition every 3 months

## If You Stay Consistent

In 12–18 months:

You'll be able to:

- Build production-ready AI vision systems
- Understand research papers
- Apply for AI/ML internships
- Publish projects on GitHub