ML Projects

**Image Processing**

Image processing is a computer technology applied to images that help us process,analyze and extract useful information from them.

**Use Cases:**

1. **Medical Imaging / Visualization**: Help medical professionals interpret medical imaging and diagnose anomalies faster.
2. **Law Enforcement & Security**: Aid in surveillance & biometric authentication.
3. **Self-Driving Technology**: Assist in detecting objects and mimicking human visual cues & interactions.
4. **Gaming**: Improving augmented reality and virtual reality gaming experiences.
5. **Image Restoration & Sharpening**: Improve the quality of images or add popular filters etc.
6. **Pattern Recognition:**Classify and recognize objects/patterns in images and understand contextual information.
7. **Image Retrieval**: Recognize images for faster retrieval from large datasets.

**WORKING:**

1. **ML algorithms need a considerable amount of high-quality data to learn and predict highly accurate results.**

**Make sure the images are well processed, annotated, and generic for ML image processing**

**This is where Computer Vision (CV) comes into the picture; it's a field concerning machines being able to understand the image data. Using CV, we can process, load, transform and manipulate images for building an ideal dataset for the machine learning algorithm.**

1. **For example, say we want to build an algorithm that will predict if a given image has a dog or a cat. For this, we'll need to collect images of dogs and cats and preprocess them using CV. The preprocessing steps include:**

* **Converting all the images into the same format.**
* **Cropping the unnecessary regions on images.**
* **Transforming them into numbers for algorithms to learn from them (array of numbers).**

1. **Computers see an input image as an array of pixels, and it depends on the image resolution. Based on the image resolution, it will see height \* width \* dimension. E.g., An image of a 6 x 6 x 3 array of a matrix of RGB (3 refers to RGB values) and an image of a 4 x 4 x 1 array of a matrix of the grayscale image.**
2. **These features (data that's processed) are then used in the next phase: to choose and build a machine-learning algorithm to classify unknown feature vectors given an extensive database of feature vectors whose classifications are known. For this, we'll need to choose an ideal algorithm; some of the most popular ones include Bayesian Nets, Decision Trees, Genetic Algorithms, Nearest Neighbors and Neural Nets etc.**

**LIBRARIES AND FRAMEWORKS REQUIRED**

**OpenCV: OpenCV-Python is a library of Python bindings designed to solve computer vision problems. It’s simple and super easy to use.**

***Highlights:***

1. **Huge library of image processing algorithms**
2. **Open Source + Great Community**
3. **Works on both images and videos**
4. **Java API Extension**
5. **Works with GPUs**
6. **Cross-Platform**

**TensorFlow: Developed by Google, Tensorflow is one of the most popular end-to-end machine learning development frameworks.**

***Highlights:***

1. **Wide range of ML, NN Algorithms**
2. **Open Source + Great Community**
3. **Work on multiple parallel processors**
4. **GPU Configured**
5. **Cross-Platform**

**PyTorch: PyTorch (by Facebook) is one of the most loved neural network frameworks for researchers. It’s more pythonic when compared with other ML libraries.**

***Highlights:***

1. **Distribution Training**
2. **Cloud Support**
3. **Open Source + Great Community**
4. **Works with GPUs**
5. **Production Ready**

**Caffe: Caffe is a deep learning framework made with expression, speed, and modularity in mind.**

***Highlights:***

1. **Open Source + Great Community**
2. **C++ Based**
3. **Expressive Architecture**
4. **Easy and Faster Execution**

**EmguCV: Emgu CV is a cross-platform .Net wrapper to the OpenCV image processing library.**

***Highlights:***

1. **Open Source and Cross-Platform**
2. **Working with .NET compatible languages – C #, VB, VC ++, IronPython, etc.**
3. **Compatible with Visual Studio, Xamarin Studio and Unity**

**MATLAB Image Processing Toolbox: Image Processing Toolbox apps let you automate common image processing workflows. You can interactively segment image data, compare image registration techniques, and batch-process large data sets.**

***Highlights:***

1. **Wide range of Deep Learning Image Processing Techniques**
2. **CUDA Enabled**
3. **3D Image Processing Workflows**

**WebGazer: WebGrazer is a JS-based library for eye tracking that uses standard webcams to infer the eye-gaze locations of web visitors on a page in real-time.**

***Highlights:***

1. **Multiple gaze prediction models**
2. **Continually supported and Open Source for 4+ years**
3. **No special hardware; WebGazer.js uses your webcam**

**Apache MarvinAI: Marvin-AI is an open-source AI platform that helps deliver complex solutions supported by a high-scale, low-latency, language-agnostic and standardized architecture while simplifying exploitation and modelling.**

***Highlights:***

1. **Open Source and Well documented**
2. **Easy to use CLI**
3. **Multi-threaded image processing**
4. **Feature extraction from image components**

**MIScnn: An open-source deep-learning-based framework for Medical Image Segmentation.**

***Highlights:***

1. **Open Source and Well Documented**
2. **Creation of segmentation pipelines**
3. **Decently pre-processing and post-processing tools**
4. **CNN Implementation**

**Kornia: PyTorch based open-source differentiable computer vision library.**

***Highlights:***

1. **Rich and low-level image processing techniques**
2. **Open Source and Great Community**
3. **Differentiable programming for large applications**
4. **Production Ready, JIT Enabled**

**VXL: VXL (the Vision-*something*-Libraries) is a collection of C++ libraries designed for computer vision research and implementation.**

***Highlights:***

1. **Open Source**
2. **3D Image Processing Workflows**
3. **Designing a graphical user interface**

**WRITTEN THEORY  
A page of a notebook with writing

Description automatically generated**

A piece of paper with writing on it

Description automatically generated