AIRCRAFT DETECTION

INDUSTRIAL TRAINING PRESENTATION

GROUP MEMBERS

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ABOUT DRDO

The **Defence Research and Development Organisation** (**DRDO**) is an agency of the Government of India, charged with the military's research and development, headquartered in New Delhi, India. It was formed in 1958 by the merger of the Technical Development Establishment and the Directorate of Technical Development and Production with the Defence Science Organisation. It is under the administrative control of the Ministry of Defence, Government of India.

With a network of 52 labs, engaged in developing defence technologies covering various fields, like aeronautics, electronics, land combat engineering, life sciences, missiles, and naval systems. DRDO is India's largest and most diverse research organisation. The organisation includes around 5,000 scientists belonging to the Defence Research & Development Service (DRDS) and about 25,000 other scientific, technical and supporting personnel.

VISION

- Make India prosperous by establishing world-class science and technology base.
- Provide our Defence Services decisive edge by equipping them with internationally competitive systems and solutions.

MISSION

- Design, develop and lead to production state-of-the-art sensors, weapon systems, platforms and allied equipment for our Defence Services.
- Provide technological solutions to the Defence Services to optimize combat effectiveness and to promote well-being of the troops.
- Develop infrastructure and committed quality manpower and build strong technology base.

ABOUT DTRL

Defence Terrain Research Laboratory (**DTRL**) is a laboratory of the Defence Research and Development Organization (DRDO). Located in Delhi its primary function is research and development of techniques to evaluate terrains and assess mobility potential of inaccessible areas.

The DTRL's origin dates back to 1964 when a Terrain Evaluation Cell (TEC) was set up as a unit of the DRDO. The cell's objectives were to develop techniques needed for evaluating terrain and assessing the mobility potential in inaccessible areas. It became a full-fledged laboratory in 1981, and was renamed the Defence Terrain Research Laboratory. DTRL was notified as self accounting unit on 17 September 1988

CHARTER OF DUTIES

- To develop a reliable system for prediction of terrain characteristics and derivation of military potential of various types of terrains based on modern techniques of terrain evaluation.
- To develop infrastructure, competence and instrumentation in the latest techniques related to terrain research
- To interact with the Services & other agencies including Universities for basic and applied aspects of terrain research.
- To develop methods for automatic feature extraction from remotely sensed data.
- To propagate the techniques of terrain evaluation in Defence services and conduct training in this field.
- To become the nodal agency for acquiring and processing of high resolution optical, thermal and hyper spectral imagery.

WEEK WISE SCHEDULE

	CURRICULUM SCHEDULED
WEEK 1	Introduction to Python
WEEK 2	Introduction to Keras and Spyder IDE
WEEK 3	Introduction to Neural Networks
WEEK 4	Introduction to CNN and Its Layers
WEEK 5	Understanding of Aircraft Detection and Dataset
WEEK 6	Implementation of Aircraft Detection

COMPUTER VISION

- Computer vision is the study of analysis of pictures and videos in order to achieve results similar to those by humans.

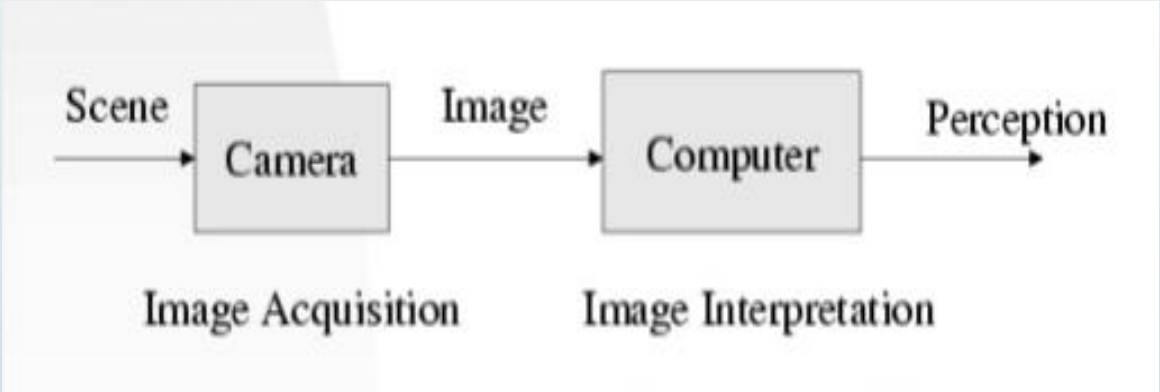


IMAGE RECOGNITION

- Image recognition is the ability of software to identify objects, places, people, writing and actions in images.
- It is used to perform a large number of machine-based visual tasks, such as labeling the content of images with meta-tags, performing image content search, guiding autonomous robots, self-driving cars and accident avoidance systems.
- Software for image recognition requires deep machine learning. Performance is best on convolutional neural networks as the specific task.
- Current and future applications of image recognition include smart photo libraries, targeted advertising, the interactivity of media, accessibility for the visually impaired and enhanced research capabilities.
- Google, Facebook, Microsoft, Apple and Pinterest are among the many companies that are investing significant resources and research into image recognition.

Human Vision VS Computer Vision

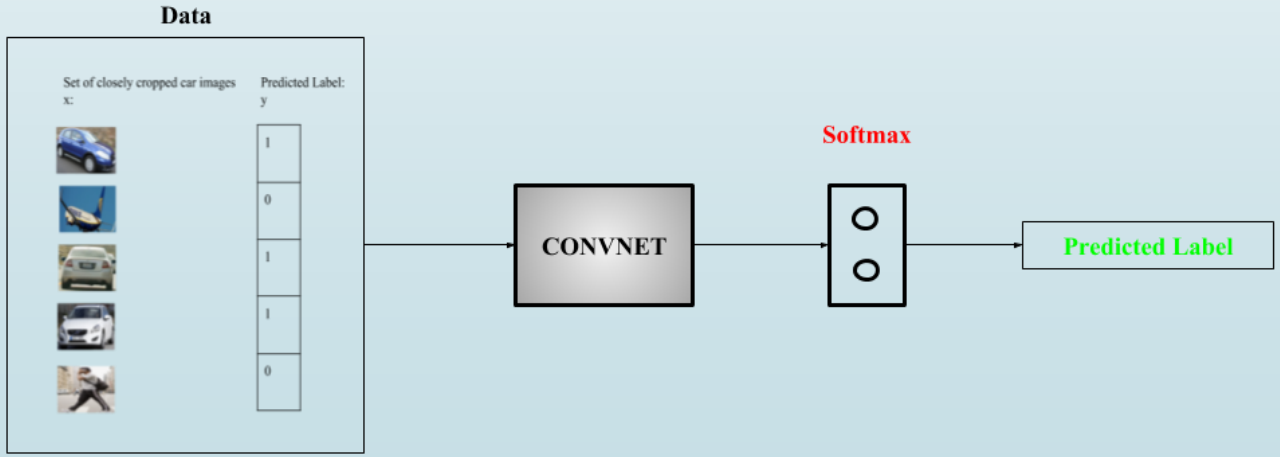
What we see

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

What a computer sees

OBJECT DETECTION

- Object Detection, a subset of Computer Vision, involves detecting instances of objects from a particular class in an image.
- Its use cases are endless, be it Tracking objects, Video surveillance, Pedestrian detection, Anomaly detection, People Counting, Self-driving cars or Face detection, the list goes on.



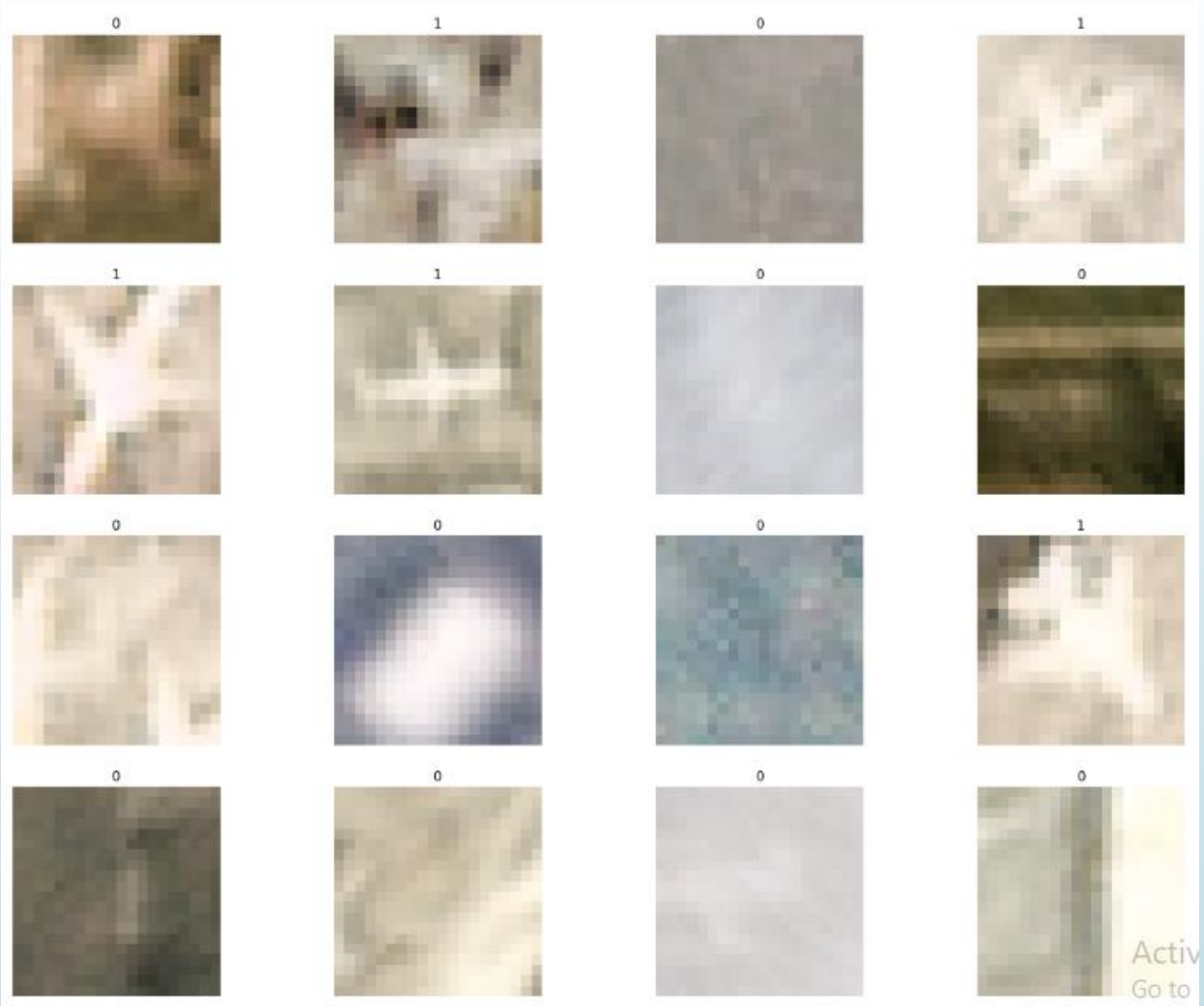
PROJECT

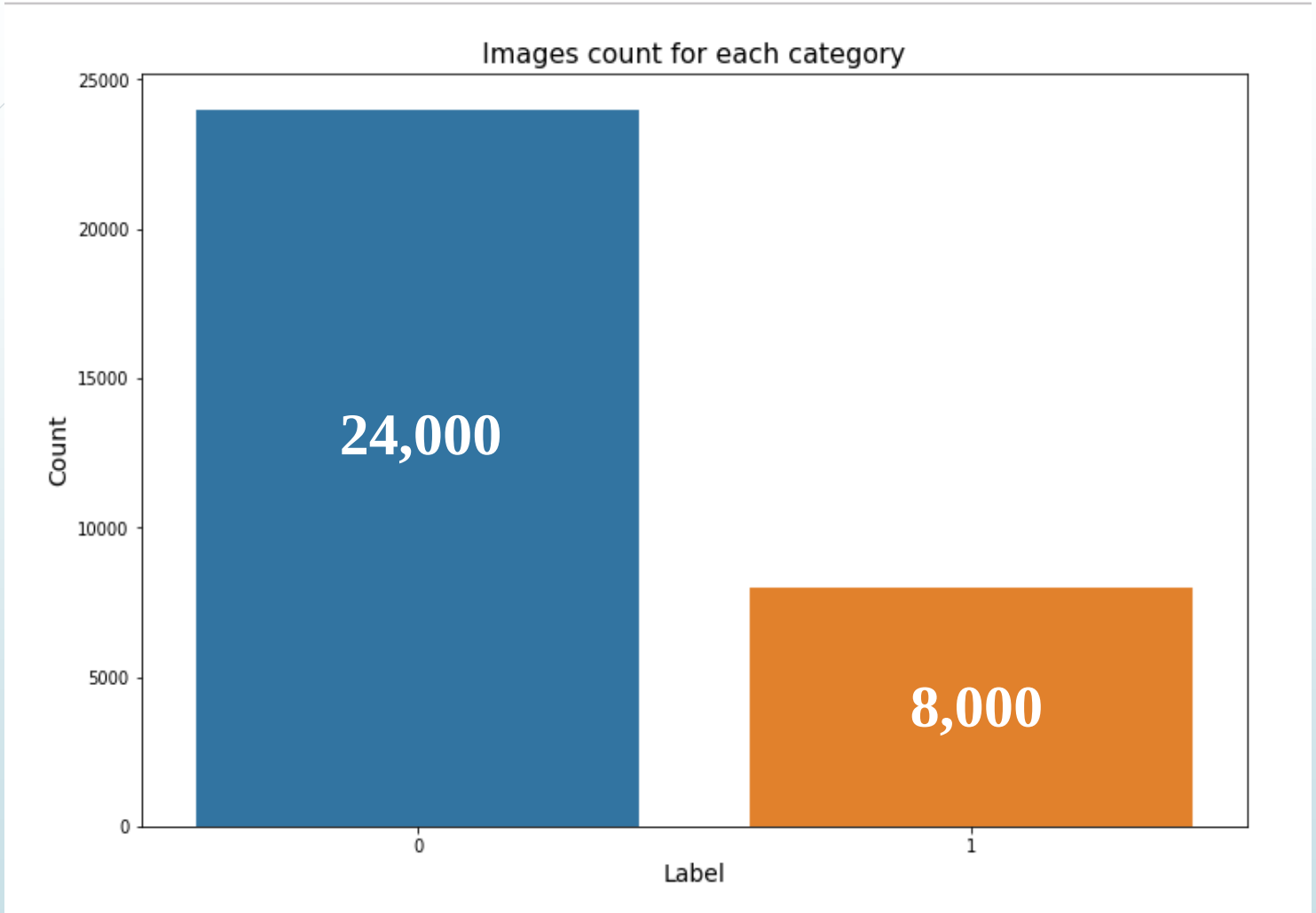
AIRCRAFT DETECTION (DETAILS)

INTRODUCTION

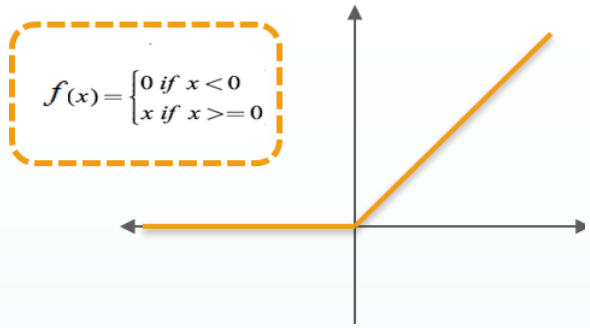
- Aircraft Detection is a deep learning project. It simply detects the probability of aircraft in the satellite's images dataset.
- Dataset is taken from kaggle (community of data scientists and machine learners). It has 32,000 satellite images with 8,000 images with aircraft and 24,000 images without images.
- Dataset is divided into 28,000 (7,000 + 21,000) training images and 4,000 (1,000 + 3,000) test images.
- Implemented in Python using Convolution Neural Network on Keras and IDE used is Spyder.

DATASET



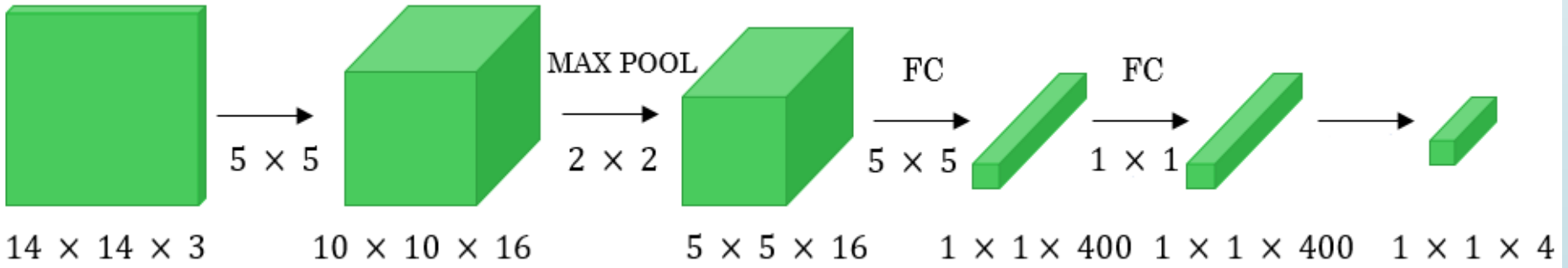

Images count for each category
25000
20000
15000
10000
5000
0
Count
24,000
8,000
0
1
Label

CNN STRUCTURE

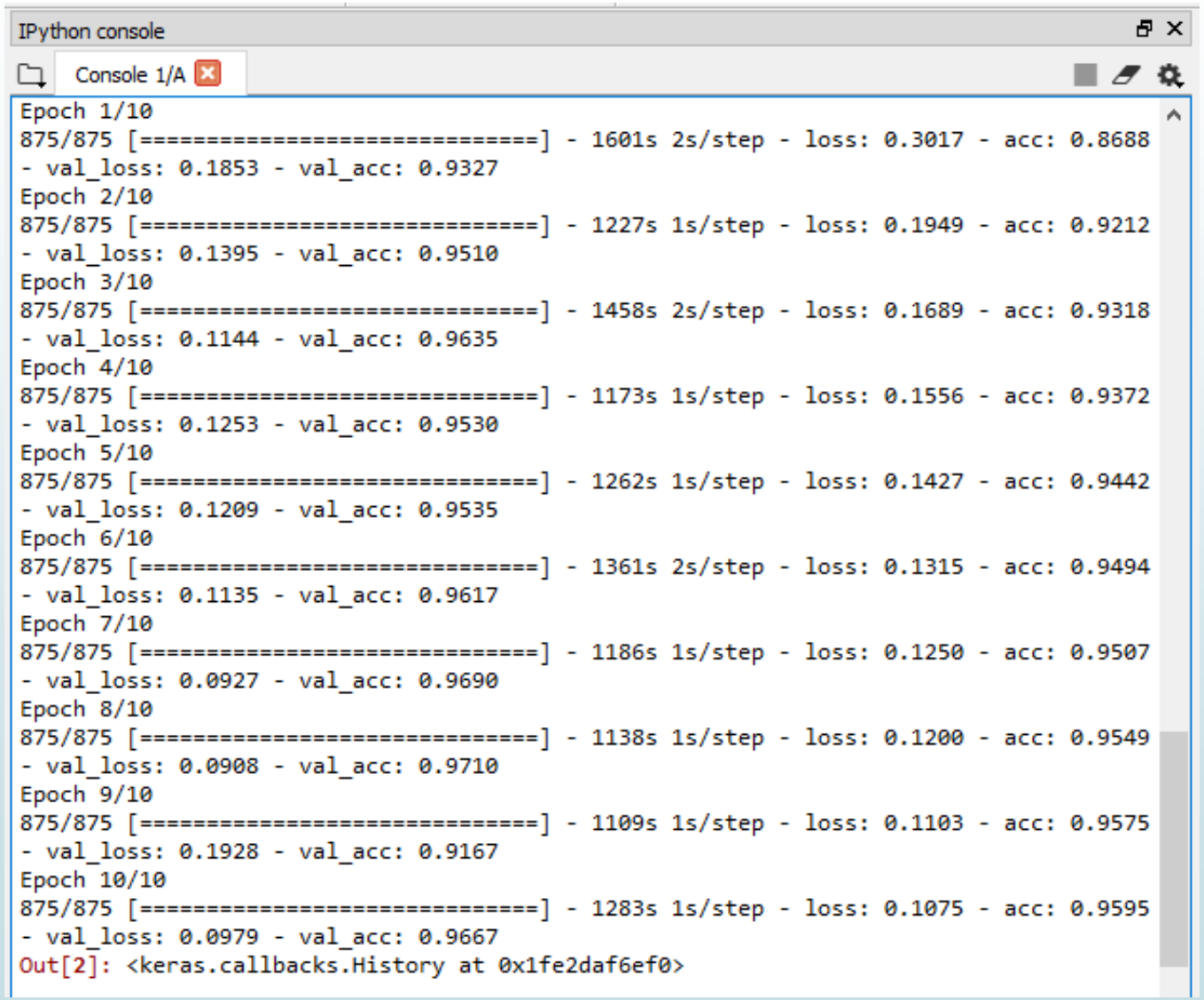


- **Convolution Layer:** It computes the output volume by computing dot product between all filters and image patch. Suppose we use total 12 filters for this layer we'll get output volume of dimension 32 x 32 x 12 (Input is 32 x 32 x 3). Two Convolution Layers are used here.
- **Activation Function Layer:** It will apply element wise activation function to the output of convolution layer. Some common activation functions are RELU: max(0, x), Sigmoid: 1/(1+e^-x), Tanh etc. The volume remains unchanged hence output volume will have dimension 32 x 32 x 12. RELU is used here.
- **Pool Layer:** It is periodically inserted in the covnets and its main function is to reduce the size of volume which makes the computation fast, reduces memory and prevents from over fitting. Two common types of are **max pooling** and **average pooling**. Max Pooling is used here.
- **Fully-Connected Layer:** It is regular neural network layer which takes input from the previous layer and computes the class scores and outputs the 1-D array of size equal to the number of classes.

Typical CNN Layer



OUTPUT


IPython console
Console 1/A
Epoch 1/10
875/875 [==============================] - 1601s 2s/step - loss: 0.3017 - acc: 0.8688
- val_loss: 0.1853 - val_acc: 0.9327
Epoch 2/10
875/875 [==============================] - 1227s 1s/step - loss: 0.1949 - acc: 0.9212
- val_loss: 0.1395 - val_acc: 0.9510
Epoch 3/10
875/875 [==============================] - 1458s 2s/step - loss: 0.1689 - acc: 0.9318
- val_loss: 0.1144 - val_acc: 0.9635
Epoch 4/10
875/875 [==============================] - 1173s 1s/step - loss: 0.1556 - acc: 0.9372
- val_loss: 0.1253 - val_acc: 0.9530
Epoch 5/10
875/875 [==============================] - 1262s 1s/step - loss: 0.1427 - acc: 0.9442
- val_loss: 0.1209 - val_acc: 0.9535
Epoch 6/10
875/875 [==============================] - 1361s 2s/step - loss: 0.1315 - acc: 0.9494
- val_loss: 0.1135 - val_acc: 0.9617
Epoch 7/10
875/875 [==============================] - 1186s 1s/step - loss: 0.1250 - acc: 0.9507
- val_loss: 0.0927 - val_acc: 0.9690
Epoch 8/10
875/875 [==============================] - 1138s 1s/step - loss: 0.1200 - acc: 0.9549
- val_loss: 0.0908 - val_acc: 0.9710
Epoch 9/10
875/875 [==============================] - 1109s 1s/step - loss: 0.1103 - acc: 0.9575
- val_loss: 0.1928 - val_acc: 0.9167
Epoch 10/10
875/875 [==============================] - 1283s 1s/step - loss: 0.1075 - acc: 0.9595
- val_loss: 0.0979 - val_acc: 0.9667
Out[2]: <keras.callbacks.History at 0x1fe2daf6ef0>

CONCLUSION

- Successfully built Aircraft Detection which is a high demand technology.
- Gained knowledge about Keras and most importantly CNN and Deep Learning Basics.

THANK YOU