

Deep Learning Workflow

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Agenda


- Google Colab
- Numpy
- Image Processing with scikit-image
 - Image Enhancement
 - Segmentation
 - Feature Extraction
- Machine Learning with scikit - learn
- Deep Learning with keras

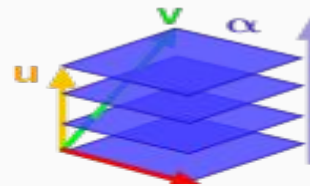
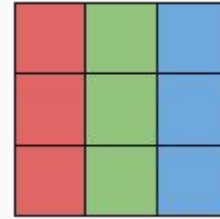


- Executable document -> **Write, Run , Share Code** (Google Drive)
- Colab is built on the top Jupyter Notebook
- Notebook Document is composed of cells, which can contain code, text, images and more.
- A runtime is associated with notebook (UNIX system) and it runs in browser.
- **Execute the python code** without any setup

FREE GPU!!

Data Representation in Neural Network

- Basic Data Structure for Neural Network **Tensor**
- Container for Numbers
- Property of Tensor - **Dimension (or) Axis (or) Rank**
 - 0D Tensor (Scalar)
 - 1D Tensor (Vector) 
 - 2D Tensor (Matrix)
 - 3D Tensor (Cube of Numbers)



Tensor

Tensor Properties

- Number of Axes (or) rank (ndim)
- Shape (shape)
- Data Type (dtype)



Numpy

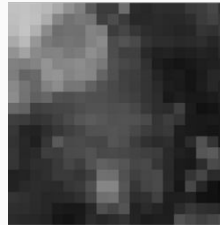
ndarray acts as a container for multidimensional items of same type and size

Numpy Arrays

0D Tensor	<code>np.array(3)</code>
1D Tensor	<code>np.array([4,5,6,8])</code>
2D Tensor	<code>np.array([[3,2], [3,1]])</code>
3D Tensor	<code>np.array([[[3,2], [3,1]], [[6,1] , [7,8]]])</code>

Scikit - image

- Scikit Image represents images as numpy arrays
- It contains various modules for processing the images.

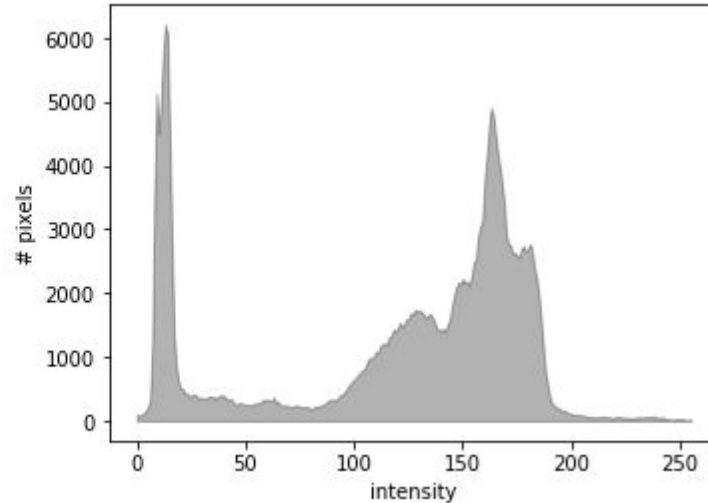


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193	194	190	184	169	144	128	89	60	60	109	44	40	46	45	45	58	61	72	50
191	195	192	173	134	114	121	116	64	77	60	41	41	43	41	41	46	60	67	57
187	196	178	139	110	113	112	132	126	61	70	55	45	42	40	37	39	53	50	59
170	186	151	122	114	117	114	131	139	76	83	74	52	45	45	41	43	46	39	47
147	163	139	131	132	121	125	143	132	78	64	64	42	33	35	30	32	36	33	43
129	126	132	148	134	136	141	133	121	81	72	67	49	30	24	21	25	30	32	34
126	101	106	146	149	132	138	134	101	80	65	62	53	37	27	28	21	28	39	40
137	117	103	130	141	118	119	99	83	74	66	60	52	42	30	27	21	29	39	33
141	115	97	103	82	79	84	80	79	74	69	64	52	45	26	31	25	25	29	35
105	99	64	67	70	71	78	83	83	79	80	72	57	46	44	65	29	18	21	27
63	60	52	56	65	75	86	92	87	82	83	81	74	53	62	52	27	26	27	25
55	37	35	46	56	64	71	82	83	85	82	73	62	54	58	30	27	25	22	24
51	40	32	54	90	73	75	71	70	85	79	62	49	43	47	29	44	82	53	25
54	39	43	63	61	75	76	83	73	75	72	68	64	61	42	33	29	86	92	69
53	41	47	47	58	70	62	83	97	92	85	71	73	55	42	27	25	45	75	70
34	36	43	47	58	58	53	65	112	111	81	65	71	74	41	28	53	70	43	43
35	42	45	43	43	54	59	80	134	133	86	55	69	74	43	23	72	39	19	13
52	48	44	39	40	42	49	69	111	115	78	46	49	65	31	31	34	19	18	15
47	46	43	39	28	25	25	40	80	71	84	35	43	37	30	44	56	48	45	41
43	40	39	35	23	19	26	44	38	44	50	36	29	31	31	81	72	63	70	76

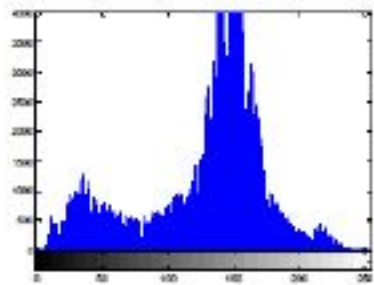
Histogram Equalization

Histogram represents the distribution of pixels

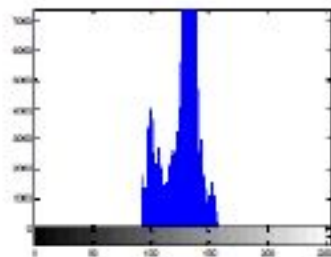


Histogram -> Contrast + Threshold

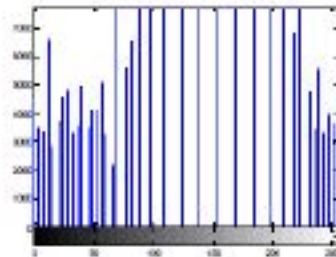
Contrast Adjustment



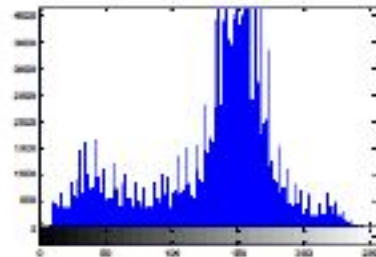
A



b

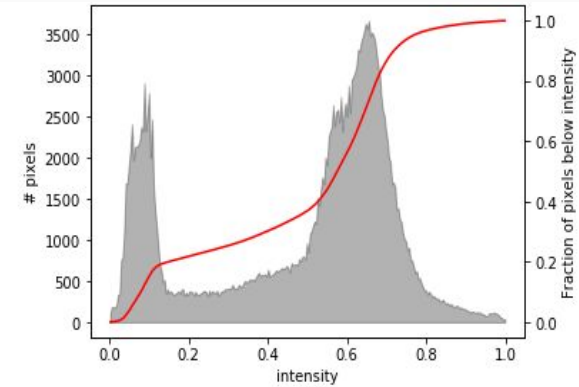
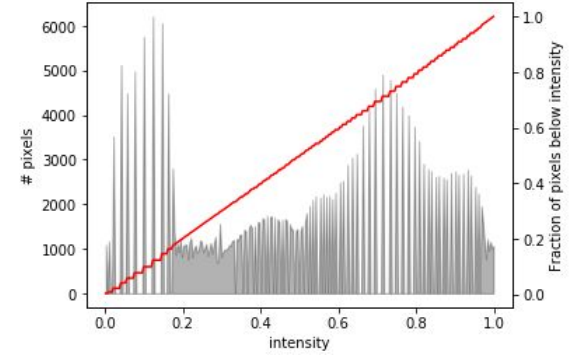
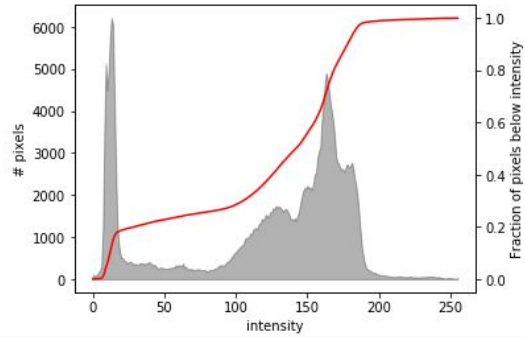


c

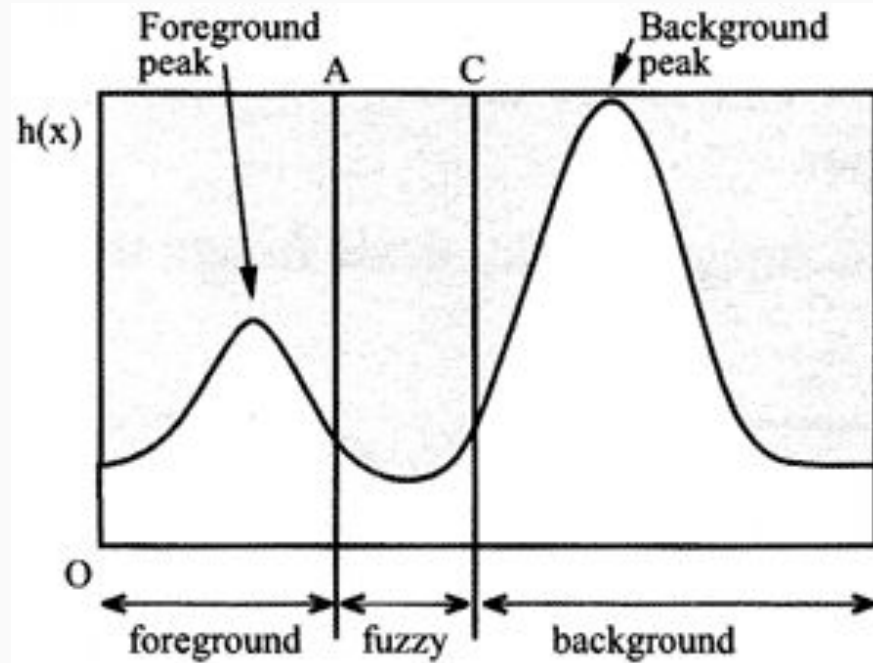


d

Cumulative Distribution Function



Segmentation (Thresholding)

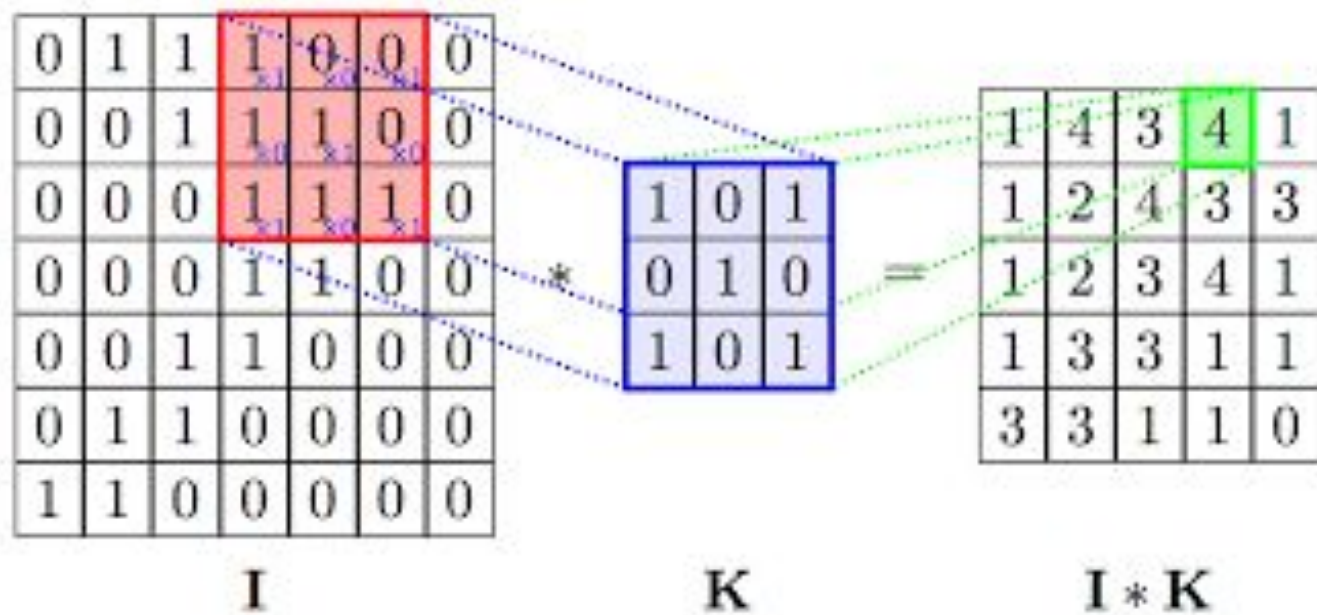


Automatic Thresholding (Otsu Method)

$$\sigma_{within}^2 = n_B(T) \cdot \sigma_B^2(T) + n_F(T) \cdot \sigma_F^2(T)$$

Edge Detection

Convolution



Significance of Filters

$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$

Mean

0	-1	0
-1	4	-1
0	-1	0

Laplacian

Sobel

-1	0	+1
-2	0	+2
-1	0	+1

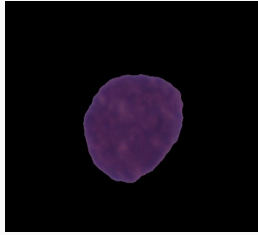
Gx

+1	+2	+1
0	0	0
-1	-2	-1

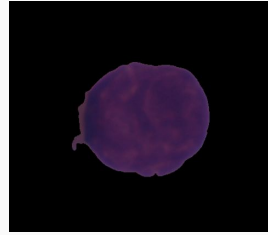
Gy

Applications

1. Differentiate between various classes of images

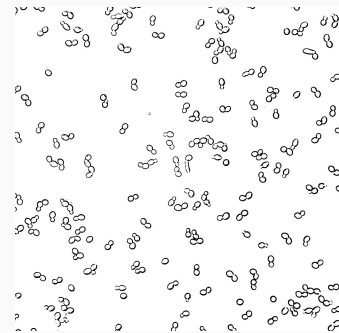
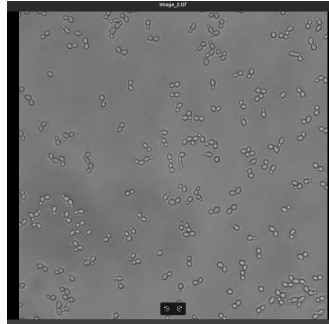


(i) Normal WBC

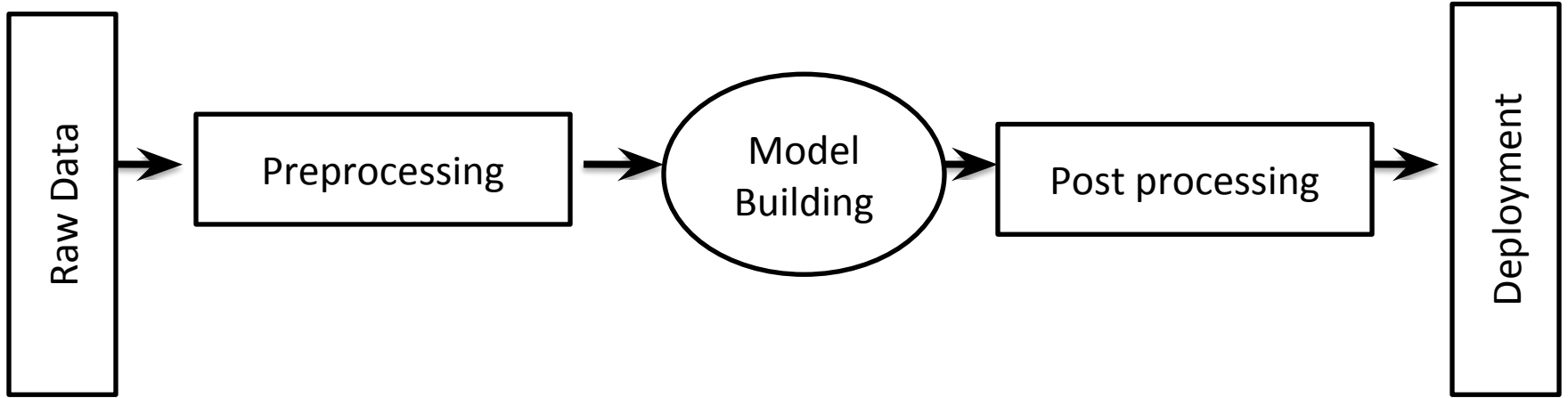


(ii) ALL (Acute Lymphoblastic Leukemia)

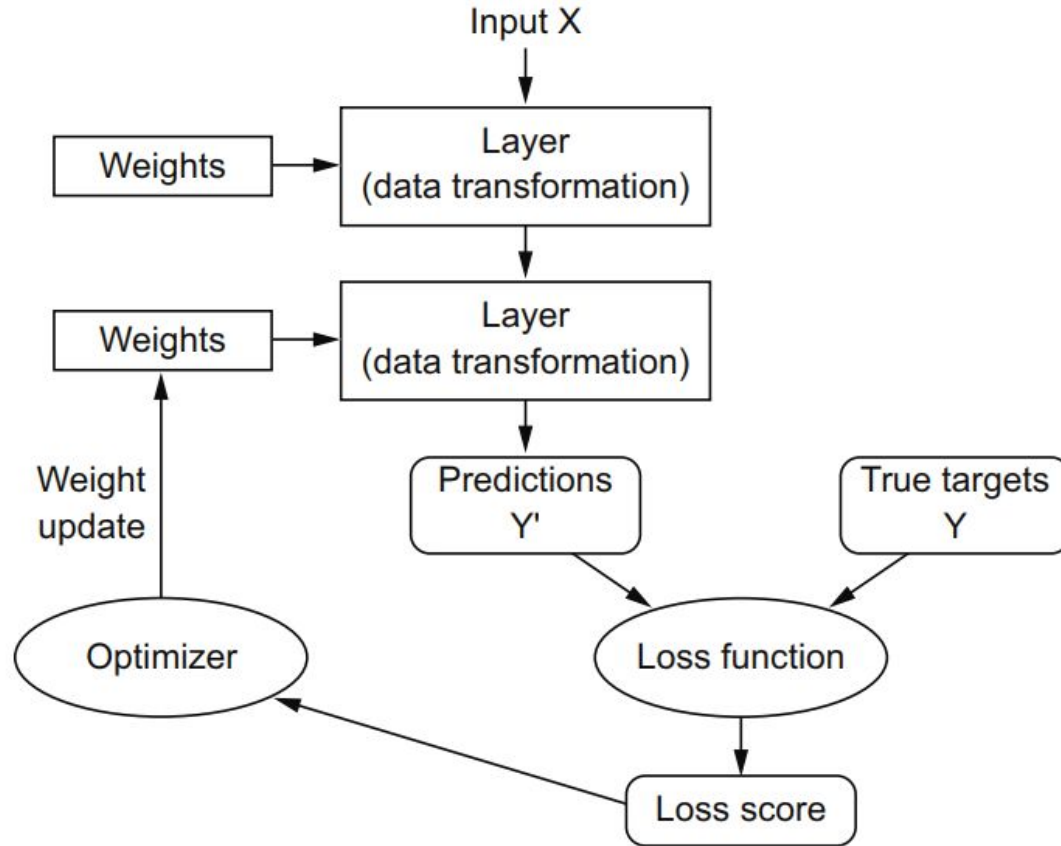
2. Identifying Objects in an image



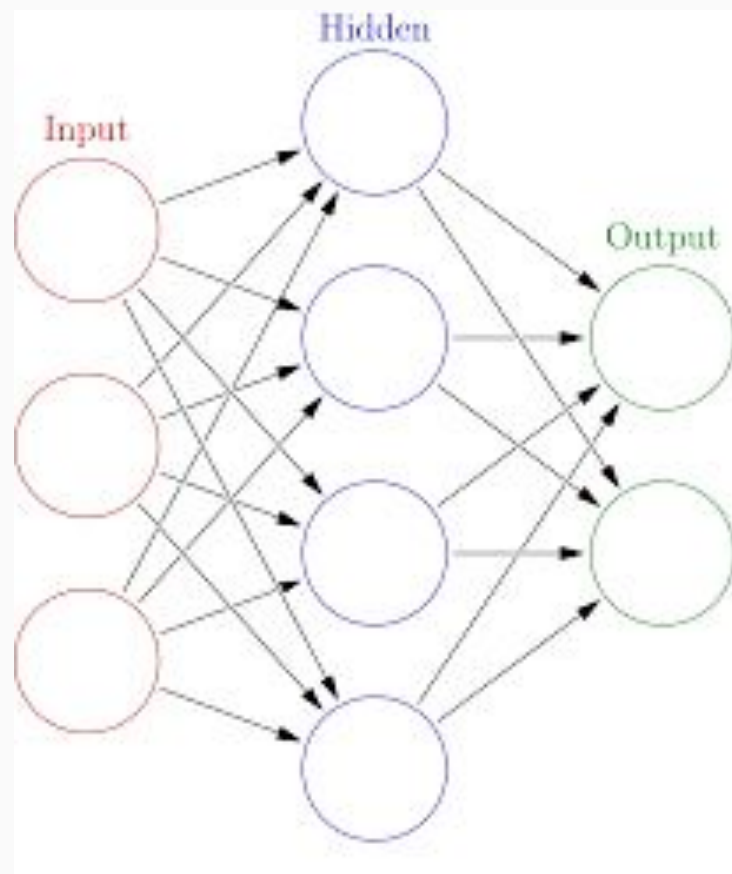
Machine Learning Workflow



Deep Learning Workflow



Artificial Neural Network



Web Links for Reference

- <https://research.google.com/seedbank>
- [Colab.research.google.com](https://colab.research.google.com)
- <http://yann.lecun.com/exdb/mnist/>