Certificate Course

On

Deep learning using Python

Faculty Coordinator: Sri.K.Pavan Kumar

Sri.N.Radha Krishna

Duration:- 05/10/2020 to 20/10/2020

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003

LIGHTED TO LIGHTEN

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Lr./KSRMCE/ (Department of ECE)/2020-21

Date: 01/10/2020

To
The Principal
KSRM College of Engineering
Kadapa, AP.

Sub: KSRMCE - (Department of ECE) – Permission to conduct certification course on Deep learning using Python – Request– Reg.

---***---

Respected Sir,

With reference to the cited, the Department of ECE is planning to conduct a certification course on Deep learning using Python for B.Tech VII sem ECE students from 05.10.2020 to 20.10.2020 in online mode. In this regard, we kindly request you to grant permission to conduct certification course. This is submitted for your kind perusal.

Thanking you sir,

forwarded to the principal sir
G.H

K. Pavan

Yours Faithfully,

Coordinators,
Sri K. Pavan Kumar
Sri N. Radha Krishna.

Cc:

To The Director for Information

To All Deans/HODs

Permitted
V.S.S. Murthy
PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003

LIGHTED TO LIGHTEN

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Date: 01/10/2020

Circular

All the B.Tech VII sem ECE students are hereby informed that the department of ECE is going to conduct 34 hours certification course on Deep learning using Python from 05/10/2020 to 20/10/2020. Interested students may register their names with following link on or before 04/10/2020.

Registration Link: https://forms.gle/G25LwAXJwcMa7cLUA

For any queries contact,

Coordinators

Sri K. Pavan Kumar
Sri N. Radha Krishna.

V.S.S. Murty

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

Cc to:

The Management /Director / All Deans / All HODS/Staff / Students for information

The IQAC Cell for Documentation

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003
Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
An ISO 14001:2004 & 9001: 2015 Certified Institution

Department of Electronics & Communication Engineering

Certificate Course on Deep learning using Python

Registered Student List

S.No.	Roll Number	Name of the Student	Year & Branch	Email id
1	179Y1A0401	ADURI VISHNU VARDHAN REDDY	B.Tech VII sem, ECE	179Y1A0401@ksrmce.ac.in
2	179Y1A0402	ALA LAKSHMI SAI GOWRI (W)	B.Tech VII sem, ECE	179Y1A0402@ksrmce.ac.in
3	179Y1A0403	AMBATI GURUSIVA	B.Tech VII sem, ECE	179Y1A0403@ksrmce.ac.in
4	179Y1A0404	AMBATI LAKSHUMAIAH	B.Tech VII sem, ECE	179Y1A0404@ksrmce.ac.in
5	179Y1A0405	ANDELA MATAM VINAY KUMAR	B.Tech VII sem, ECE	179Y1A0405@ksrmce.ac.in
6	179Y1A0406	ANKANA SUNITHA (W)	B.Tech VII sem, ECE	179Y1A0406@ksrmce.ac.in
7	179Y1A0407	ANNAREDDY VENKATA MEGHANA(W)	B.Tech VII sem, ECE	179Y1A0407@ksrmce.ac.in
8	179Y1A0408	ANUGURU VINEELA (W)	B.Tech VII sem, ECE	179Y1A0408@ksrmce.ac.in
9	179Y1A0409	ATHIKARI PRATHYUSHA (W)	B.Tech VII sem, ECE	179Y1A0409@ksrmce.ac.in
10	179Y1A0410	AVINASH, B	B.Tech VII sem, ECE	179Y1A0410@ksrmce.ac.in
11	179Y1A0411	AVULA VAMSIKRISHNA	B.Tech VII sem, ECE	179Y1A0411@ksrmce.ac.in
12	179Y1A0412	B BABU PRASAD	B.Tech VII sem, ECE	179Y1A0412@ksrmce.ac.in
13	179Y1A0413	BALAM SAINATH	B.Tech VII sem, ECE	179Y1A0413@ksrmce.ac.in
14	179Y1A0414	BALARAMIREDDYGARI BHARATH KALYAN REDDY	B.Tech VII sem, ECE	179Y1A0414@ksrmce.ac.in
15	179Y1A0416	BANDI NAVEEN KUMAR	B.Tech VII sem, ECE	179Y1A0416@ksrmce.ac.in
16	179Y1A0417	BANDI NIKHIL KUMAR	B.Tech VII sem, ECE	179Y1A0417@ksrmce.ac.in
17	179Y1A0418	BANDI PRANEETH	B.Tech VII sem, ECE	179Y1A0418@ksrmce.ac.in
18	179Y1A0419	BANTHULLA ANIL KUMAR RAJU	B.Tech VII sem, ECE	179Y1A0419@ksrmce.ac.in
19	179Y1A0420	BASIREDDY MAHESH KUMAR REDDY	B.Tech VII sem, ECE	179Y1A0420@ksrmce.ac.in
20	179Y1A0421	BATHALA MANOJ	B.Tech VII sem, ECE	179Y1A0421@ksrmce.ac.in
21	179Y1A0422	BAYYARAPU SURESH	B.Tech VII sem, ECE	179Y1A0422@ksrmce.ac.in
22	179Y1A0423	BHEEMAVARAPU VARA LAKSHMI (W)	B.Tech VII sem, ECE	179Y1A0423@ksrmce.ac.in

23	179Y1A0424	BHUMIREDDY KUNTOLLA SURESH	B.Tech VII sem, ECE	179Y1A0424@ksrmce.ac.in
24	179Y1A0425	BOYA GUNASEKHAR	B.Tech VII sem, ECE	179Y1A0425@ksrmce.ac.in
25	179Y1A0426	BUKKEY RAKESH NAIK	B.Tech VII sem, ECE	179Y1A0426@ksrmce.ac.in
26	179Y1A0427	CHAGALETI SURYA NARAYANA REDDY	B.Tech VII sem, ECE	179Y1A0427@ksrmce.ac.in
27	179Y1A0428	CHAMARTHI SANJEEVARAJU	B.Tech VII sem, ECE	179Y1A0428@ksrmce.ac.in
28	179Y1A0429	CHAVVA JASWITHA (W)	B.Tech VII sem, ECE	179Y1A0429@ksrmce.ac.in
29	179Y1A0431	CHILLA VENKATESWARA REDDY	B.Tech VII sem, ECE	179Y1A0431@ksrmce.ac.in
30	179Y1A0432	CHILLATHOTI KEERTHI (W)	B.Tech VII sem, ECE	179Y1A0432@ksrmce.ac.in
31	179Y1A0433	DADIBOYINA LOHITHA (W)	B.Tech VII sem, ECE	179Y1A0433@ksrmce.ac.in
32	179Y1A0434	DANDEBOYINA NAVYA SREE (W)	B.Tech VII sem, ECE	179Y1A0434@ksrmce.ac.in
33	179Y1A0435	DARA SEKHAR	B.Tech VII sem, ECE	179Y1A0435@ksrmce.ac.in
34	179Y1A0436	DEVAGUDI VENKATA SUBBAIAH	B.Tech VII sem, ECE	179Y1A0436@ksrmce.ac.in
35	179Y1A0437	DOKKUPALLI RAJESH KUMAR REDDY	B.Tech VII sem, ECE	179Y1A0437@ksrmce.ac.in
36	179Y1A0438	DOMMARAJU RAM MOHAN RAJU	B.Tech VII sem, ECE	179Y1A0438@ksrmce.ac.in
37	179Y1A0439	DUGGIREDDY VENKATA THARUN KUMAR REDDY	B.Tech VII sem, ECE	179Y1A0439@ksrmce.ac.in
38	179Y1A0440	ERIGELA MOUNIKA (W)	B.Tech VII sem, ECE	179Y1A0440@ksrmce.ac.in
39	179Y1A0441	ETHAKOTI RAJESH	B.Tech VII sem, ECE	179Y1A0441@ksrmce.ac.in
40	179Y1A0442	G B SIDDA UMA MAHESWARA REDDY	B.Tech VII sem, ECE	179Y1A0442@ksrmce.ac.in
41	179Y1A0443	GAJJALA DIVYA	B.Tech VII sem, ECE	179Y1A0443@ksrmce.ac.in
42	179Y1A0445	GAJJALA VENKATA ROHITHKUMAR REDDY	B.Tech VII sem, ECE	179Y1A0445@ksrmce.ac.in
43	179Y1A0446	GAJULAPALLI VENKATAPRASANNA (W)	B.Tech VII sem, ECE	179Y1A0446@ksrmce.ac.in
44	179Y1A0447	GALIGUTTA VIDYA (W)	B.Tech VII sem, ECE	199YIA0447@ksrmce.ac.in
45	179Y1A0448	GANDHAM ARAVINDA SAI	B.Tech VII sem, ECE	179Y1A0448@ksrmce.ac.in
46	179Y1A0449	GANGARAPU MYTHRI (W)	B.Tech VII sem, ECE	179Y1A0449@ksrmce.ac.in
47	179Y1A0452	GOPARAJULU RENUKA HARSHITHA (W)	B.Tech VII sem, ECE	179Y1A0452@ksrmce.ac.in
48	179Y1A0454	GORLA SUSHMITHA REDDY (W)	B.Tech VII sem, ECE	179Y1A0454@ksrmce.ac.in
49	179Y1A0455	GUDURU HARIKRISHNA	B.Tech VII sem, ECE	179Y1A0455@ksrmce.ac.in
50	179Y1A0456	GUNDLADURTHI BALAYALLA REDDY	B.Tech VII sem, ECE	179Y1A0456@ksrmce.ac.in
51	179Y1A0457	IDAGOTTU VENKATA SAI CHARAN	B.Tech VII sem, ECE	179Y1A0457@ksrmce.ac.in
52	179Y1A0458	JULAKALVA NIRANJANAREDDY	B.Tech VII sem, ECE	179Y1A0458@ksrmce.ac.in

53	179Y1A0459	KALLURU SUNANDHANA (W)	B.Tech VII sem, ECE	179Y1A0459@ksrmce.ac.in
54	179Y1A0460	KAMBAM VASU KALYAN REDDY	B.Tech VII sem, ECE	179Y1A0460@ksrmce.ac.in
55	179Y1A0461	KAMBELLA SAMBA	B.Tech VII sem, ECE	179Y1A0461@ksrmce.ac.in
56	179Y1A0463	KANALA PRAMOD KUMAR REDDY	B.Tech VII sem, ECE	179Y1A0463@ksrmce.ac.in
57	179Y1A04A4	PICHALA VINOD KUMAR REDDY	B.Tech VII sem, ECE	179Y1A04A4@ksrmce.ac.in
58	179Y1A04A5	POGILI SIVALAHARI (W)	B.Tech VII sem, ECE	179Y1A04A5@ksrmce.ac.in
59	179Y1A04A6	POLEPALLI VIJAYA VANI (W)	B.Tech VII sem, ECE	179Y1A04A6@ksrmce.ac.in
60	179Y1A04A8	PULICHERLA YASWANTH REDDY	B.Tech VII sem, ECE	179Y1A04A8@ksrmce.ac.in
61	179Y1A04A9	RAMACHANDRAPPA GARI BHARATH	B.Tech VII sem, ECE	179Y1A04A9@ksrmce.ac.in
62	179Y1A04B0	RANADHIR REDDY U	B.Tech VII sem, ECE	179Y1A04B0@ksrmce.ac.in
63	179Y1A04B1	RANGAREDDIGARI NITHYA SREE (W)	B.Tech VII sem, ECE	179Y1A04B1@ksrmce.ac.in
64	179Y1A04B3	RUDRARAJU CHARAN KUMAR RAJU	B.Tech VII sem, ECE	179Y1A04B3@ksrmce.ac.in
65	179Y1A04B4	SAMPATHI REDDY ESWARSAI	B.Tech VII sem, ECE	179Y1A04B4@ksrmce.ac.in
66	179Y1A04B5	SETTIPALLI PAVAN KALYAN	B.Tech VII sem, ECE	179Y1A04B5@ksrmce.ac.in
67	179Y1A04B6	SHAIK ATHAR	B.Tech VII sem, ECE	179Y1A04B6@ksrmce.ac.in
68	179Y1A04B7	SHAIK FUZAIL	B.Tech VII sem, ECE	179Y1A04B7@ksrmce.ac.in
69	179Y1A04B9	SHAIK MOHAMMAD SHAKEER	B.Tech VII sem, ECE	179Y1A04B9@ksrmce.ac.in
70	179Y1A04C0	SHAIK MOHAMMED SHARIF	B.Tech VII sem, ECE	179Y1A04C0@ksrmce.ac.in
71	179Y1A04C1	SHAIK NOOR MOHAMMED	B.Tech VII sem, ECE	179Y1A04C1@ksrmce.ac.in

Coordinator

HOD
Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003.

V. S. S. Murthy
Principal
PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

Deep Learning Using Python

Overview:

Deep learning is the machine learning technique behind the most exciting capabilities in diverse areas like robotics, natural language processing, image recognition, and artificial intelligence, including the famous AlphaGo.

Course Objectives:

- Study the basic concepts of neural networks.
- Study the basic concepts of deep learning.

Course Outcomes:

- Understand the context of neural networks and deep learning.
- Know how to use neural networks.

Module I:

An introduction to neural networks, neurons, layers, multilayer neural networks, different types of activation functions, examples.

Module II:

Introduction to deep learning, seeking deep learning: network types, development frameworks and network models, deep learning development flow, application space.

Module III:

Introduction to popular open source libraries: Tensor flow, keras, pyTorch, using keras to classify hand written digits, using keras to classify images of objects.

Module IV:

Training neural networks: Linear regression, Logistic regression, Back propagation, code examples of a neural network for the XOR function.

Textbooks:

1. Python Deep Learning by Ivan Vasilev, Daniel Slater, CianmarioSpaceagna, Peter Roelants and Valentino Zocca, 2^{nd} edition, PACKT.

Reference Textbook:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

Web references:

1. Neural Network and Its Applications , Prof. SomnathSengupta , IIT Kharagpur.
2. https://www.simplilearn.com/tutorials/deep-learning-tutorial/deep-learning-with-python

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003.

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Department of Electronics& Communication Engineering

Certificate Course on Deep learning using Python

Schedule

S.No	Date	Time	Faculty	Topic
1	05/10/2020	3PM to 5PM	Dr.D.ArunKumar Sri K.Pavan Kumar Sri N.Radha Krishna	Inauguration
2	06/10/2020	3PM to 5PM	Dr.D.ArunKumar	An introduction to neural networks, neurons, layers
3	07/10/2020	3PM to 5PM	Dr.D.ArunKumar	multilayer neural networks, different types of activation functions
4	08/10/2020	3PM to 5PM	Dr.D.ArunKumar	Introduction to deep learning
5	09/10/2020	3PM to 5PM	Dr.D.ArunKumar	seeking deep learning: network types, development frameworks and network models
6	10/10/2020	3PM to 5PM	Dr.D.ArunKumar	Deep learning development flow, application space.
7	11/10/2020	3PM to 5PM	Dr.D.ArunKumar	Introduction to popular open source libraries
8	12/10/2020	3PM to 5PM	Sri.K.Pavan Kumar	Tensor flow,
9	13/10/2020	3PM to 5PM	Dr.D.ArunKumar	keras
10	14/10/2020	3PM to 5PM	Sri.N.Radha Krishna	pyTorch, using keras to classify hand written digits
11	15/10/2020	3PM to 5PM	Dr.D.ArunKumar	usingkeras to classify images of objects.
12	16/10/2020	3PM to 5PM	Sri.K.Pavan Kumar	Training neural networks
13	17/10/2020	3PM to 5PM	Sri.K.Pavan Kumar	Linear regression, Logistic regression
14	18/10/2020	3PM to 5PM	Sri.N.Radha Krishna	Back propagation
15	19/10/2020	3PM to 6PM	Sri.N.Radha Krishna	Code examples of a neural network for the XOR function

16	20/10/2020	3 PM to 6PM	Dr.D.ArunKumar Sri.N.Radha Krishna Sri.K.Pavan Kumar	Exam and Certificate Distribution

K.Pav

Coordinators

G. ...

HOD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003.

V. S. S. Murthy

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

ACTIVITY REPORT

Certification Course

On

"DEEP LEARNING USING PYTHON"

05th October, 2020 to 20th October, 2020

Target Group	:	Students
Details of Participants	:	71 Students
Co-ordinators	:	Sri K. Pavan Kumar, Asst. Prof, Dept. of ECE Sri N. Radha Krishna, Asst. Prof, Dept. of ECE
Organizing Department	:	Department of Electronics & Communication Engineering
Venue	:	Online mode (Google meet)

Description:

Certification course on "DEEP LEARNING USING PYTHON" was organized by Dept. of ECE from 05th October 2020 to 20th October 2020 in online mode. Dr. D. Arun Kumar, Sri K. Pavan Kumar and Sri N. Radha Krishna acted as Course instructors. The main aim of the course is to learn the basic concepts of the neural networks and Deep learning. This 34 Hours course was successfully completed and participation certificates were provided to the participants.

Photo :

Sri. K. Pavan Kumar

Sri. N. Radha Krishna

Coordinators

V.S.S. Murthy

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

K.S.R.M. COLLEGE OF ENGINEERING

UGC - Autonomous

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
Kadapa, Andhra Pradesh, India– 516 003

Certificate Course on

Deep Learning using Python

05/10/2020 to 20/10/2020

Organized by

DEPARTMENT OF
ELECTRONICS AND COMMUNICATION ENGINEERING

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

LIGHTED TO LIGHTEN

Department of Electronics & Communication Engineering

Certificate Course on Deep Learning using Python

Attendance Sheet

S.No.	Roll No.	Name of the Student	05/10/2020	06/10/2020	07/10/2020	08/10/2020	09/10/2020	10/10/2020	11/10/2020	12/10/2020	13/10/2020	14/10/2020	15/10/2020	16/10/2020	17/10/2020	18/10/2020	19/10/2020	20/10/2020
1	179Y1A0401	ADURI VISHNU VARDHAN REDDY	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
2	179Y1A0402	ALA LAKSHMI SAI GOWRI (W)	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	179Y1A0403	AMBATI GURUSIVA	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	179Y1A0404	AMBATI LAKSHUMAIAH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
5	179Y1A0405	ANDELA MATAM VINAY KUMAR	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	179Y1A0406	ANKANA SUNITHA (W)	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
7	179Y1A0407	ANNAREDDY VENKATA MEGHANA(W)	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	179Y1A0408	ANUGURU VINEELA (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	179Y1A0409	ATHIKARI PRATHYUSHA (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	179Y1A0410	AVINASH, B	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	179Y1A0411	AVULA VAMSIKRISHNA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

12	179Y1A0412	B BABU PRASAD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
13	179Y1A0413	BALAM SAINATH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	179Y1A0414	BALARAMIREDDYGARI BHARATH KALYAN REDDY	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
15	179Y1A0416	BANDI NAVEEN KUMAR	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
16	179Y1A0417	BANDI NIKHIL KUMAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17	179Y1A0418	BANDI PRANEETH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
18	179Y1A0419	BANTHULLA ANIL KUMAR RAJU	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18	179Y1A0420	BASIREDDY MAHESH KUMAR REDDY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓
20	179Y1A0421	BATHALA MANOJ	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
21	179Y1A0422	BAYYARAPU SURESH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
22	179Y1A0423	BHEEMAVARAPU VARA LAKSHMI (W)	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
23	179Y1A0424	BHUMIREDDY KUNTOLLA SURESH	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
24	179Y1A0425	BOYA GUNASEKHAR	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
25	179Y1A0426	BUKKEY RAKESH NAIK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
26	179Y1A0427	CHAGALETI SURYA NARAYANA REDDY	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
27	179Y1A0428	CHAMARTHI SANJEEVARAJU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
28	179Y1A0429	CHAVVA JASWITHA (W)	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
29	179Y1A0431	CHILLA VENKATESWARA REDDY	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
30	179Y1A0432	CHILLATHOTI KEERTHI (W)	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
31	179Y1A0433	DADIBOYINA LOHITHA (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
32	179Y1A0434	DANDEBOYINA NAVYA SREE (W)	✓	✓	✗	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓
33	179Y1A0435	DARA SEKHAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
34	179Y1A0436	DEVAGUDI VENKATA SUBBAIAH	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
35	179Y1A0437	DOKKUPALLI RAJESH KUMAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓

		REDDY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓
36	179Y1A0438	DOMMARAJU RAM MOHAN RAJU	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
37	179Y1A0439	DUGGIREDDY VENKATA THARUN KUMAR REDDY	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
38	179Y1A0440	ERIGELA MOUNIKA (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
39	179Y1A0441	ETHAKOTI RAJESH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	X
40	179Y1A0442	G B SIDDA UMA MAHESWARA REDDY	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
41	179Y1A0443	GAJJALA DIVYA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
42	179Y1A0445	GAJJALA VENKATA ROHITHKUMAR REDDY	✓	✓	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
43	179Y1A0446	GAJULAPALLI VENKATAPRASANNA (W)	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
44	179Y1A0447	GALIGUTTA VIDYA (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
45	179Y1A0448	GANDHAM ARAVINDA SAI	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓
46	179Y1A0449	GANGARAPU MYTHRI (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
47	179Y1A0452	GOPARAJULU RENUKA HARSHITHA (W)	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
48	179Y1A0454	GORLA SUSHMITHA REDDY (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
49	179Y1A0455	GUDURU HARIKRISHNA	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
50	179Y1A0456	GUNDLADURTHI BALAYALLA REDDY	✓	X	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X
51	179Y1A0457	IDAGOTTU VENKATA SAI CHARAN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
52	179Y1A0458	JULAKALVA NIRANJANAREDDY	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
53	179Y1A0459	KALLURU SUNANDHANA (W)	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
54	179Y1A0460	KAMBAM VASU KALYAN REDDY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
55	179Y1A0461	KAMBELLA SAMBA	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
56	179Y1A0463	KANALA PRAMOD KUMAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		REDDY	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
57	179Y1A04A4	PICHALA VINOD KUMAR REDDY	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
58	179Y1A04A5	POGILI SIVALAHARI (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
59	179Y1A04A6	POLEPALLI VIJAYA VANI (W)	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60	179Y1A04A8	PULICHERLA YASWANTH REDDY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
61	179Y1A04A9	RAMACHANDRAPPA GARI BHARATH	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
62	179Y1A04B0	RANADHIR REDDY U	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
63	179Y1A04B1	RANGAREDDIGARI NITHYA SREE (W)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
64	179Y1A04B3	RUDRARAJU CHARAN KUMAR RAJU	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
65	179Y1A04B4	SAMPATHI REDDY ESWARSAI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
66	179Y1A04B5	SETTIPALLI PAVAN KALYAN	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
67	179Y1A04B6	SHAIK ATHAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
68	179Y1A04B7	SHAIK FUZAIL	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓
69	179Y1A04B9	SHAIK MOHAMMAD SHAKEER	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
70	179Y1A04C0	SHAIK MOHAMMED SHARIF	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
71	179Y1A04C1	SHAIK NOOR MOHAMMED	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Coordinators

HOD

Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003.

V.S.S. Murthy

PRINCIPAL

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

Practical deep learning

Lecture 1: Introduction to deep learning

About this course

- Introduction to deep learning
  - basics of ML assumed
  - mostly high-school math
  - much of theory, many details skipped
- 1st day: lectures + small-scale exercises using notebooks.csc.fi
- 2nd day: mid-scale experiments using GPUs at Taito-GPU
- Slides at: https://tinyurl.com/y83ctvug
- Other materials (and link to Gitter) at GitHub: https://github.com/csc-training/intro-to-dl/
- Focus on text and image classification, no fancy stuff
- Using Python, Keras, and PyTorch

Further resources

- This course is largely "inspired by":
  "Deep Learning with Python" by François Chollet
- Recommended textbook:
  "Deep learning" by Goodfellow, Bengio, Courville
- Lots of further material available online, e.g.:
  http://cs231n.stanford.edu/ http://course.fast.ai/
  https://developers.google.com/machine-learning/crash-course/
  www.nvidia.com/dlilabs http://introtodeeplearning.com/
  https://github.com/oxford-cs-deepnlp-2017/lectures
- Academic courses

What is artificial intelligence?

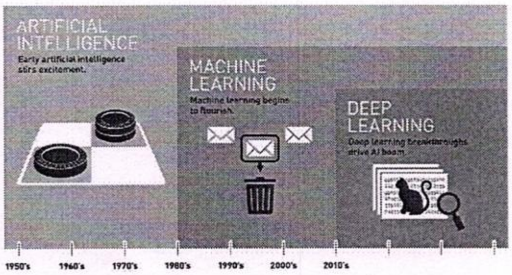
Artificial intelligence is the ability of a computer to perform tasks commonly associated with intelligent beings.

What is machine learning?

Machine learning is the study of algorithms that learn from examples and experience instead of relying on hard-coded rules and make predictions on new data.

What is deep learning?

Deep learning is a subfield of machine learning focusing on learning data representations as successive layers of increasingly meaningful representations.



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Image from

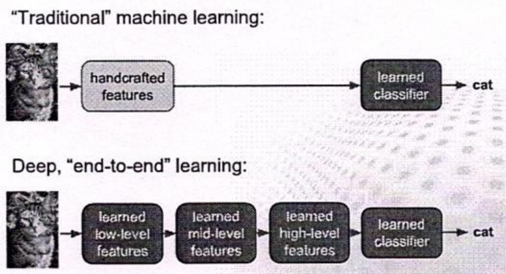


Table 1: Major milestones that will be covered in this paper

Year	Contributer	Contribution
300 BC	Aristotle	introduced Associationism, started the history of human's attempt to understand brain
1873	Alexander Bain	introduced Neural Groupings as the earliest models of neural network, inspired Hebbian Learning Rule
1943	McCulloch & Pitts	introduced MCP Model, which is considered as the ancestor of Artificial Neural Model
1949	Donald Hebb	considered as the father of neural networks, introduced Hebbian Learning Rule, which lays the foundation of modern neural network
1958	Frank Rosenblatt	introduced the first perceptron, which highly resembles modern perceptron
1974	Paul Werbos	introduced Backpropagation
1980	Teuvo Kohonen	introduced Self Organizing Map
	Kunihiko Fukushima	introduced Neocogitron, which inspired Convolutional Neural Network
1982	John Hopfield	introduced Hopfield Network
1985	Hilton & Sejnowski	introduced Boltzmann Machine
1986	Paul Smolensky	introduced Harmonium, which is later known as Restricted Boltzmann Machine
	Michael I. Jordan	defined and introduced Recurrent Neural Network
1990	Yann LeCun	introduced LeNet, showed the possibility of deep neural networks in practice
1997	Schuster & Paliwal	introduced Bidirectional Recurrent Neural Network
	Hochreiter & Schmidhuber	introduced LSTM, solved the problem of vanishing gradient in recurrent neural networks
2006	Geoffrey Hinton	introduced Deep Belief Networks, also introduced layer-wise pretraining technique, opened current deep learning era
2009	Salakhutdinov & Hinton	introduced Deep Boltzmann Machines
2012	Geoffrey Hinton	introduced Dropout, an efficient way of training neural networks

From: Wang & Raj: On the Origin of Deep Learning (2017)

Demotivational slide

"All of these AI systems we see, none of them is 'real' AI"
– Josh Tennenbaum

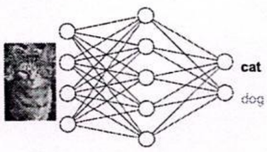
"Neural networks are … neither neural nor even networks."
– François Chollet, author of Keras

Main types of machine learning

Main types of machine learning

- **Supervised learning**

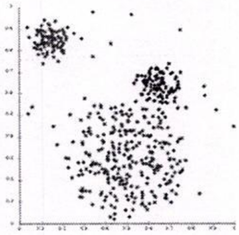
- Unsupervised learning
- Self-supervised learning
- Reinforcement learning



Main types of machine learning

- Supervised learning

- **Unsupervised learning**
- Self-supervised learning
- Reinforcement learning



By Chire [illegible], from Wikimedia Commons

Main types of machine learning

- Supervised learning

- Unsupervised learning
- **Self-supervised learning**
- Reinforcement learning

Image from [illegible]

Main types of machine learning

- Supervised learning

- Unsupervised learning
- Self-supervised learning
- **Reinforcement learning**

Animation from [illegible]

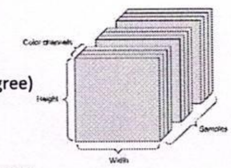
Fundamentals of machine learning

Data

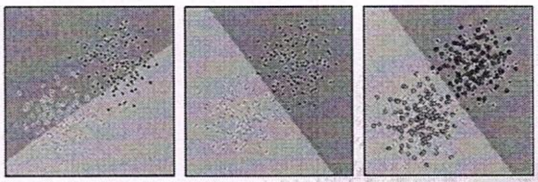
- Humans learn by observation and unsupervised learning
  - model of the world / common sense reasoning
- Machine learning needs lots of (labeled) data to compensate

Data

- Tensors: generalization of matrices to *n* dimensions (or rank, order, degree)
  - 1D tensor: vector
  - 2D tensor: matrix
  - 3D, 4D, 5D tensors
  - `numpy.ndarray(shape, dtype)`
- Training – validation – test split (+ adversarial test)
- Minibatches
  - small sets of input data used at a time



Model – learning/training – inference



- $\hat{y} = f(\mathbf{x};\theta)$
- parameters θ and hyperparameters

http://playground.tensorflow.org/

Optimization

- Mathematical optimization:
  "the selection of a best element (with regard to some criterion) from some set of available alternatives" (Wikipedia)
- Main types:
  finite-step, iterative, heuristic
- Learning as an optimization problem
  - cost function:

$$J(\theta) = \frac{1}{m}\sum_{i=1}^{m} \underbrace{L(f(\mathbf{x}_i;\theta), y_i)}_{\text{loss}} + \underbrace{R(\theta)}_{\text{regularization}}$$

Optimization

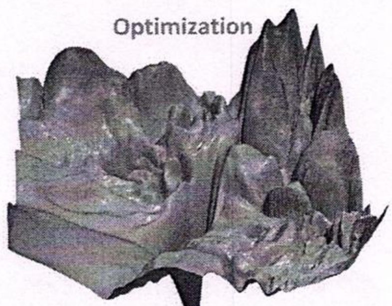


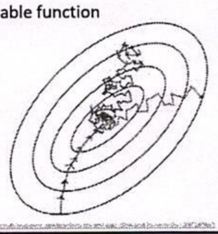
Image from: Li et al. "Visualizing the Loss Landscape of Neural Nets", arXiv:1712.09913

Gradient descent

- Derivative and minima/maxima of functions
- Gradient: the derivative of a multivariable function
- Gradient descent:

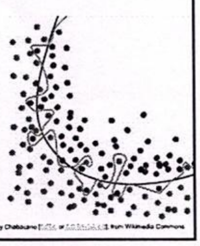
$$\theta_{t+1} = \theta_t - \alpha \frac{\partial J(\theta)}{\partial \theta}$$

- (Mini-batch) stochastic gradient descent (and its variants)



Over- and underfitting, generalization, regularization

- Models with lots of parameters can easily overfit to training data
- **Generalization:** the quality of ML model is measured on new, unseen samples
- **Regularization:** any method* to prevent overfitting
  - simplicity, sparsity, dropout, early stopping
  - *) other than adding more data

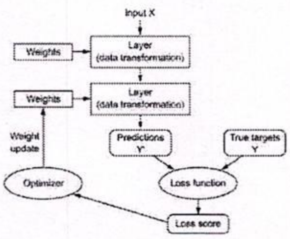


By Chabacano, from Wikimedia Commons

Deep learning

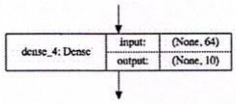
Anatomy of a deep neural network

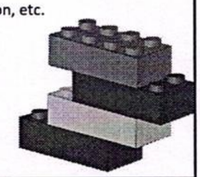
- Layers
- Input data and targets
- Loss function
- Optimizer



Layers

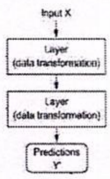
- Data processing modules
- Many different kinds exist
  - densely connected
  - convolutional
  - recurrent
  - pooling, flattening, merging, normalization, etc.
- Input: one or more tensors
  output: one or more tensors
- Usually have a state, encoded as **weights**
  - learned, initially random
- When combined, form a **network** or a **model**

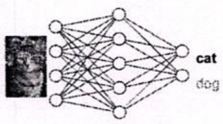




Input data and targets

- The network maps the input data X to predictions Y'
- During training, the predictions Y' are compared to true targets Y using the loss function



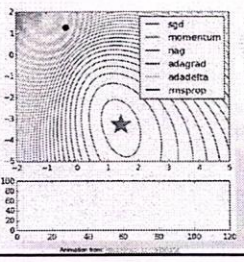


Loss function

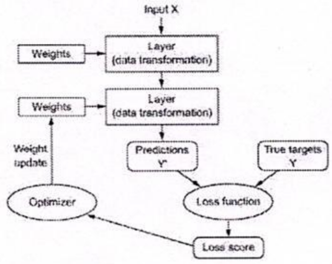
- The quantity to be minimized (optimized) during training
  - the only thing **the network** cares about
  - there might also be other metrics **you** care about
- Common tasks have "standard" loss functions:
  - *mean squared error* for regression
  - *binary cross-entropy* for two-class classification
  - *categorical cross-entropy* for multi-class classification
  - etc.
- https://lossfunctions.tumblr.com/

Optimizer

- How to update the weights based on the loss function
- *Learning rate*
- Stochastic gradient descent, momentum, and their variants
  - RMSProp is usually a good first choice
  - more info: http://ruder.io/optimizing-gradient-descent/



Anatomy of a deep neural network

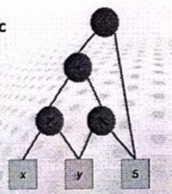


Deep learning frameworks

Caffe · torch · Chainer · PyTorch · DEEPLEARNING4J · Caffe2 · TensorFlow · K · dmlc mxnet · theano

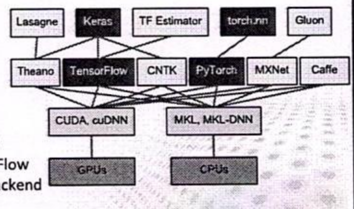
Deep learning frameworks

- Actually tools for defining **static** or **dynamic** general-purpose **computational graphs**
- Automatic differentation
- Seamless CPU / GPU usage
  - multi-GPU, distributed
- Python/numpy or R interfaces
  - instead of C, C++, or CUDA
- Open source



$$xy + 5y + 5$$

Deep learning frameworks



- Keras is a high-level neural networks API
  - we will use TensorFlow as the compute backend
  - https://keras.io/
- PyTorch is:
  - a GPU-based tensor library
  - an efficient library for dynamic neural networks
  - https://pytorch.org/

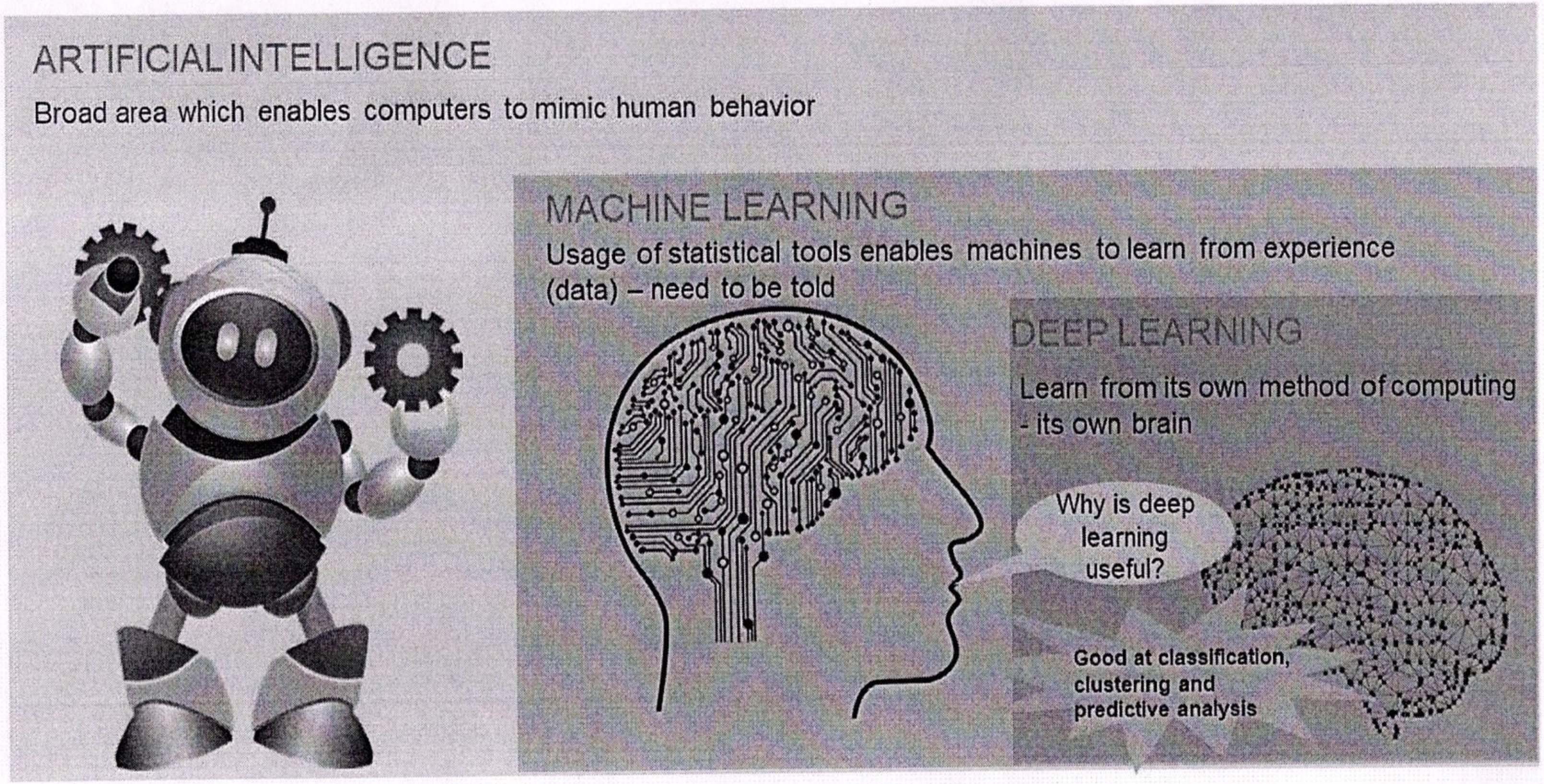
Introduction to Deep Learning

Agenda

Introduction to deep learning:

- What is deep learning?
- Speaking deep learning: network types, development frameworks and network models
- Deep learning development flow
- Application spaces

Deep learning introduction



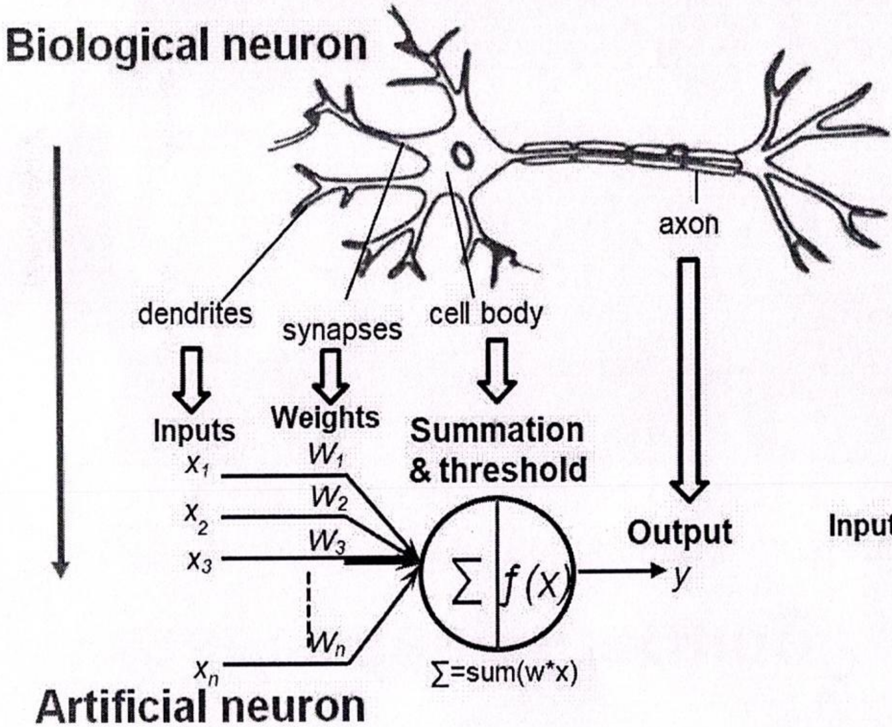
What is deep learning?

Deep learning is way of classifying, clustering, and predicting things by using a neural network that has been trained on vast amounts of data.

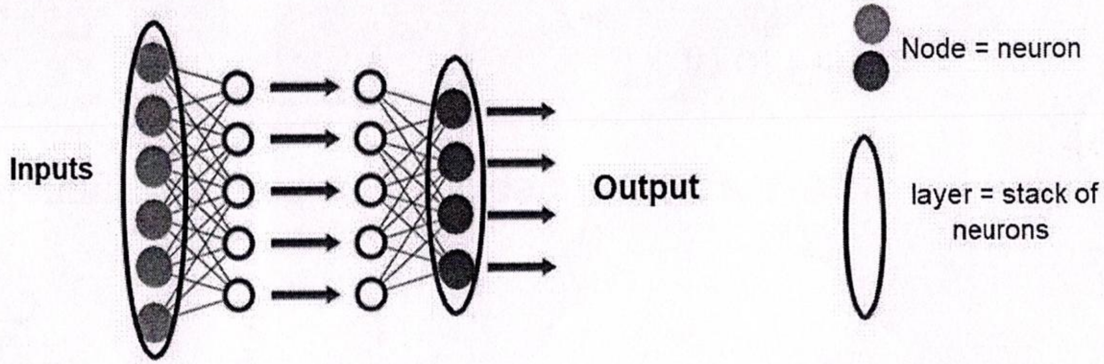
Picture of deep learning demo done by TI's automotive driver assistance systems (ADAS) team.

What is deep learning?

- Deep learning has its roots in neural networks.
- Neural networks are sets of algorithms, modeled loosely after the human brain, that are designed to **recognize patterns**.

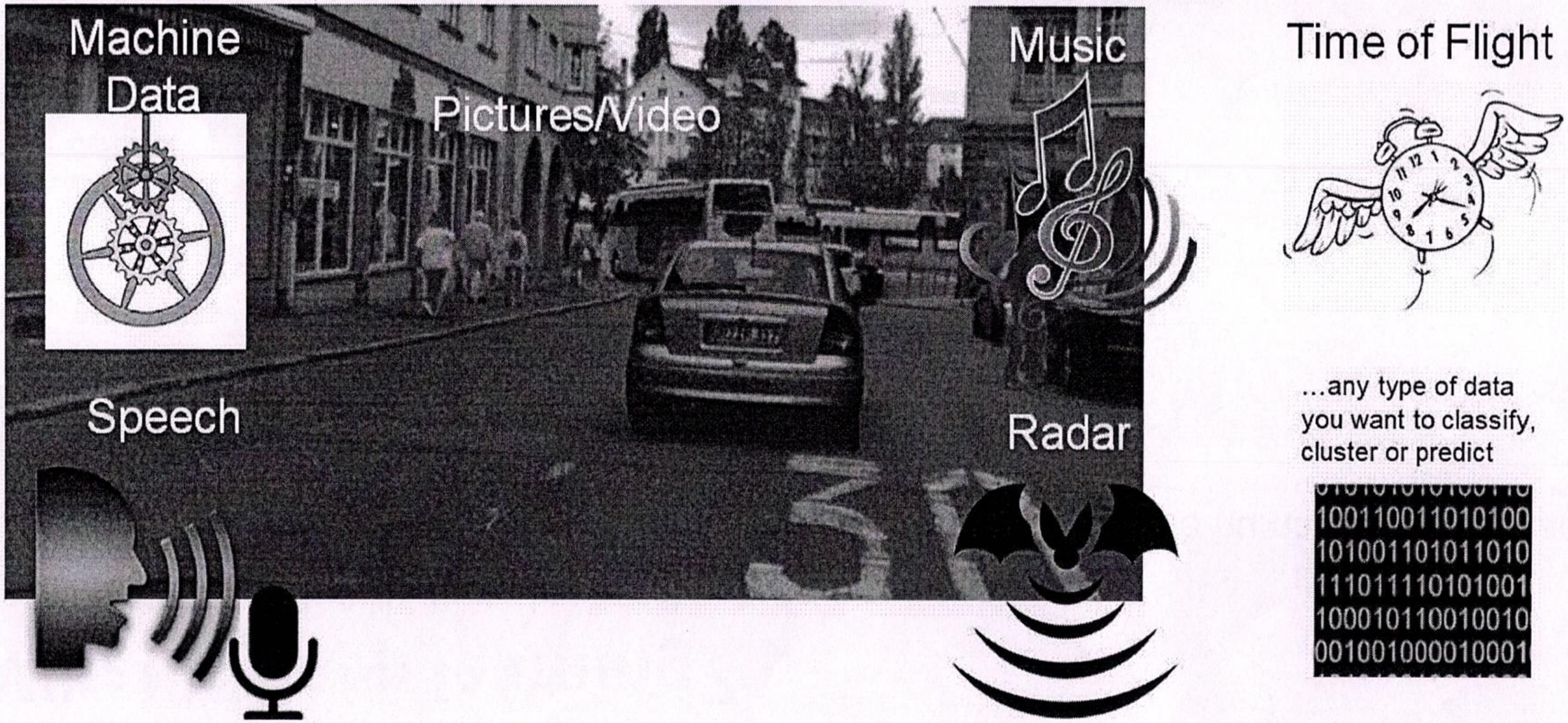


Biologocal neuron	Artificial neuron
dendrites	inputs
synapses	weight
axon	output
cell body	summation and threshold

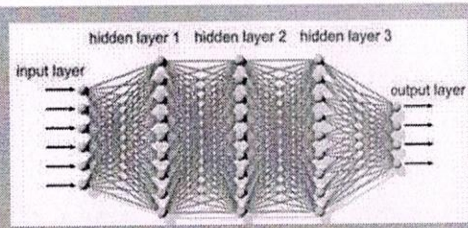
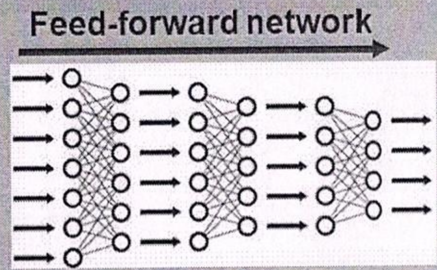
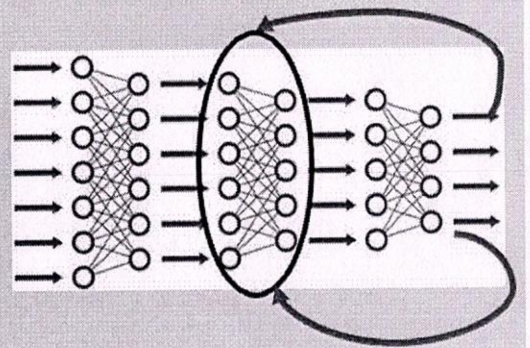


What is deep learning?

Deep learning is way of **classifying, clustering, and predicting things** by using a neural network that has been trained on vast amounts of data.

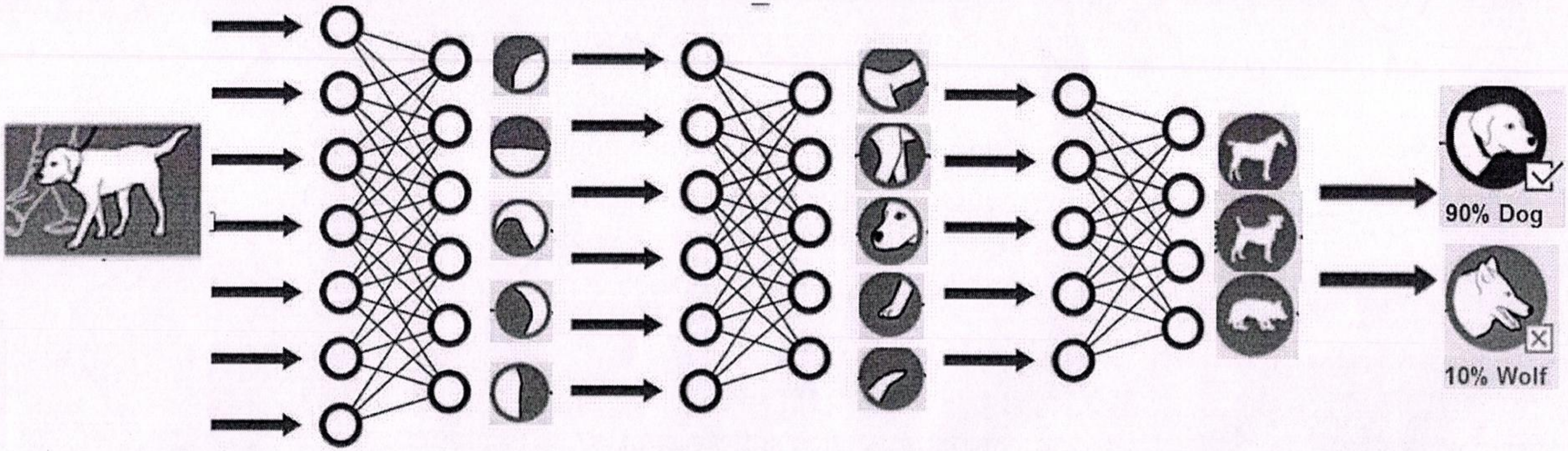


Deep Neural Networks (DNN)

Multi Layer Perceptron (**MLP**)	• One of the most traditional types of DL architectures • Every element of a previous layer, is connected to every element of the next layer. Such layer is called dense layer. • Fell out of favor, in part because they are hard to train	
Convolution Neural Network (**CNN**)	• Type of feedforward deep neural network • Takes a fixed size inputs and generates fixed-size outputs • Mostly used in computer vision applications for object detection, classification and semantic segmentation • Ideal for image and video processing	
Recurrent Neural Network (**RNN**)	• Feedforward neural networks extended to include feedback connections • Use their internal memory to process arbitrary sequence of inputs, hence can handle arbitrary input/output length • Useful for time series data where features representing the past are assumed to have bearing on the future • Ideal for text and speech analysis	 cyclical connect

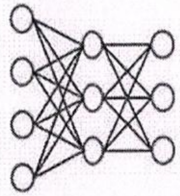
What is deep learning?

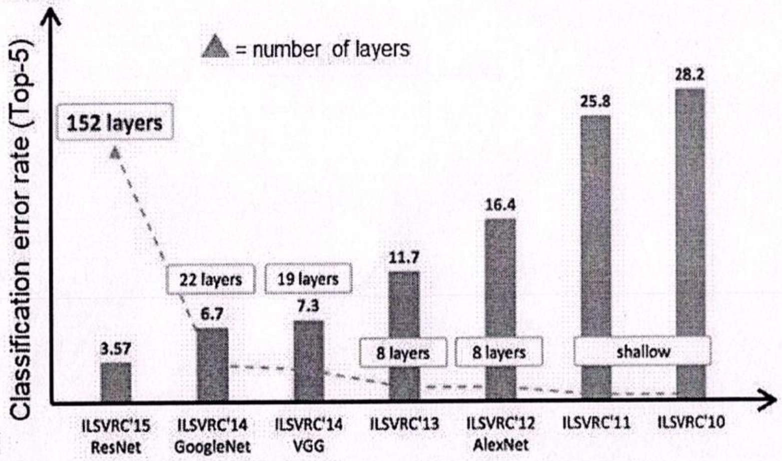
Deep learning creates many layers of neurons, attempting to learn structured representation of big data, layer by layer.



Architecture of the network: Network models

- Deep neural networks are mathematical models of intelligence designed to mimic human brains.
- Network models define a set of network layers and how they interact.
- Questions to answer while designing a network models include:
  - Which layer type to use?
  - How many neurons to use in each layer?
  - How are layers arranged?
  - And more
- There are many standard CNN models available today which work great for many standard problems. Examples being AlexNet, GoogleNet, Inception-ResNet, VGG, etc.

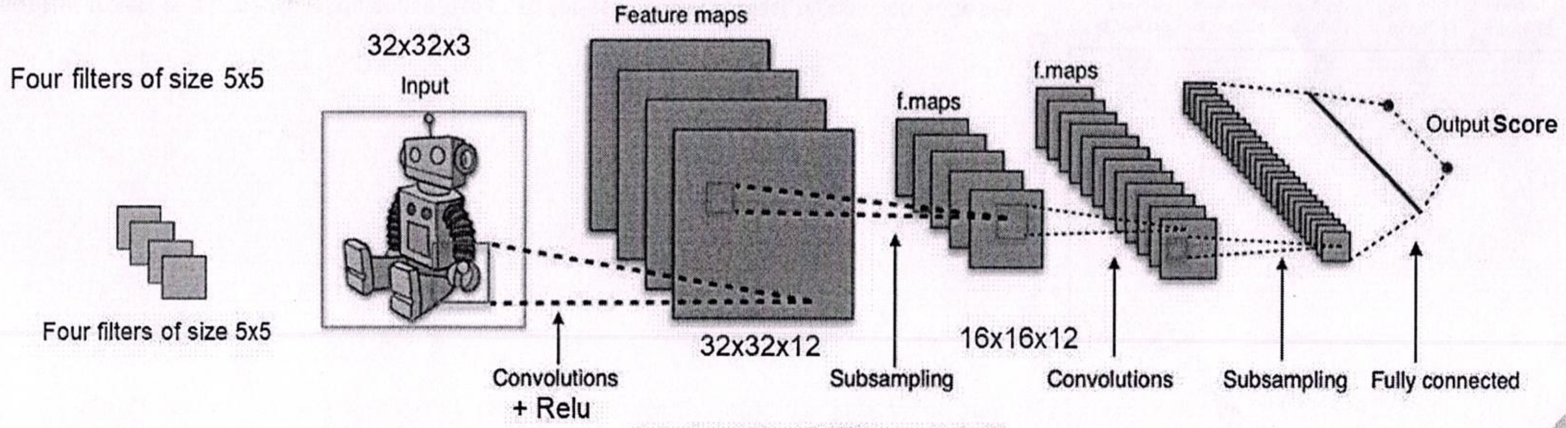




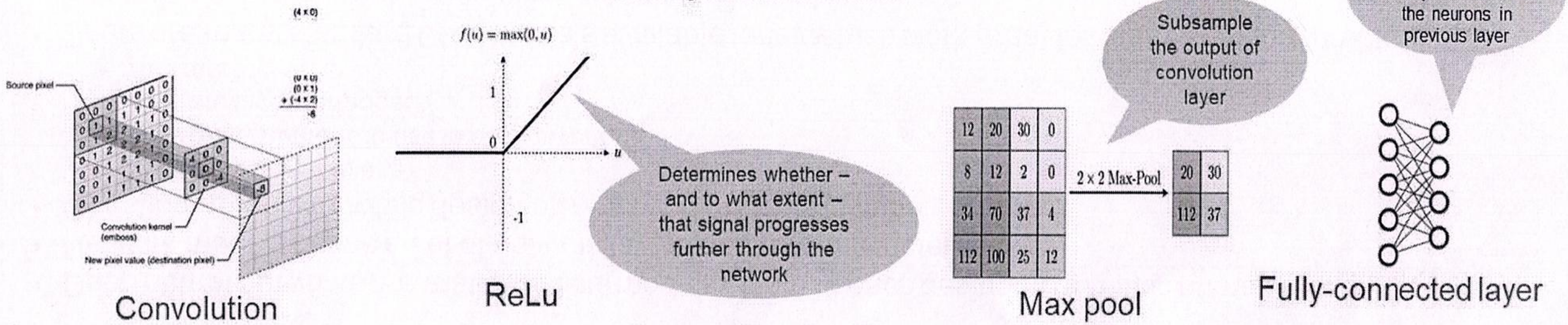
ILSVRC annual contest year and winning model

The **ImageNet** project is a large visual database designed for use in visual object recognition software research. Since 2010, the ImageNet project runs an annual software contest – The ImageNet Large Scale Visual Recognition Challenge (ILSVRC), where software programs compete to correctly classify and detect objects and scenes.

Typical layers involved in CNN



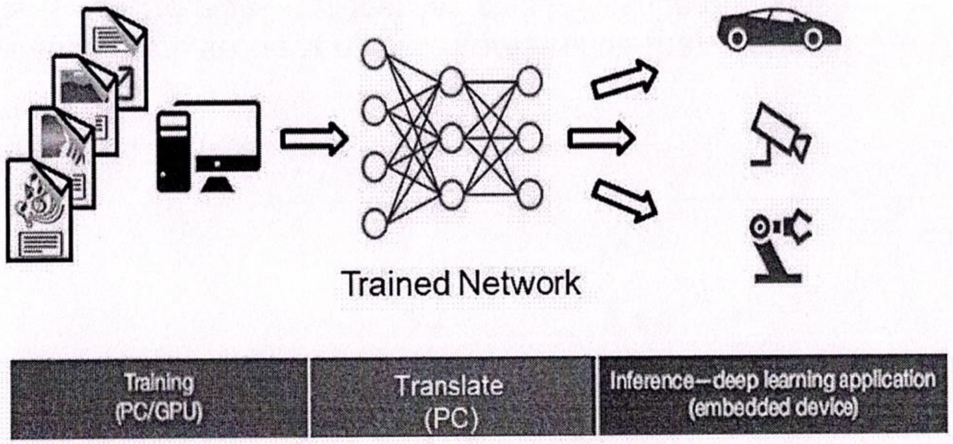
Example CNN model

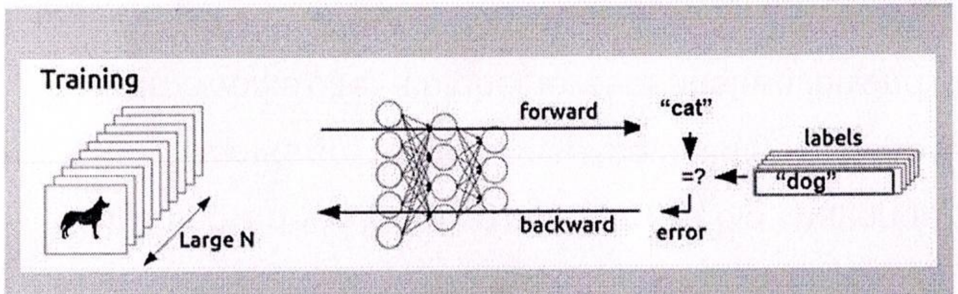


Layers involved

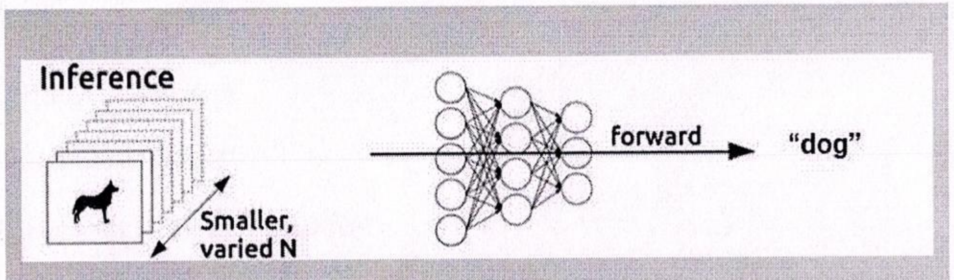
Deep learning development flow

1. Selection of a framework for development
2. Selecting labeled data set of classes to train the network upon
3. Designing initial network model
4. Training the network
5. Saving the parameters and architecture in a binary file
6. Inference





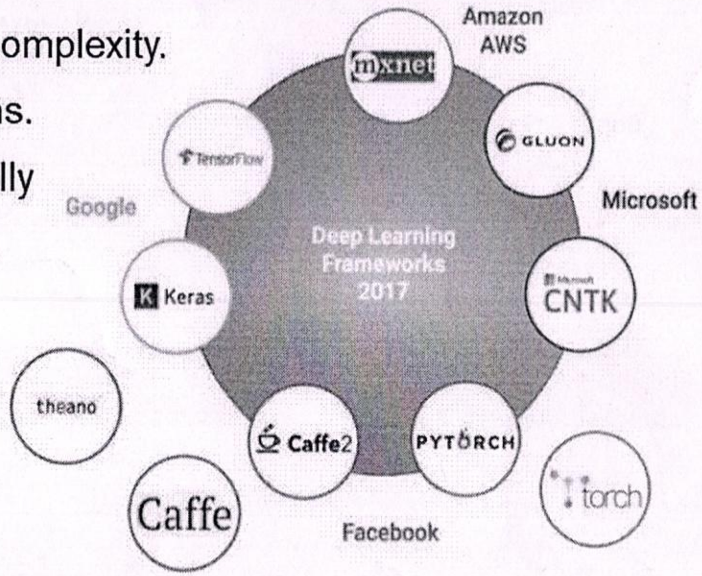
CNN training



CNN deployment

Deep learning frameworks

- Building a deep learning solution is a big challenge because of its complexity.
- Frameworks are tools to ease the building of deep learning solutions.
- Frameworks offer a higher level of abstraction and simplify potentially difficult programming tasks.



Popular Frameworks:

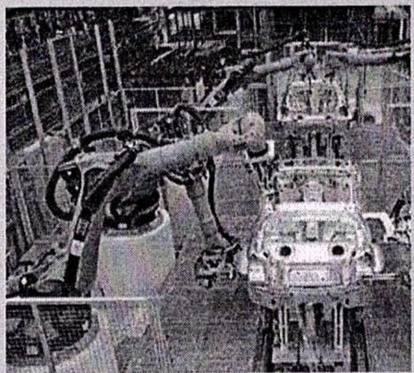
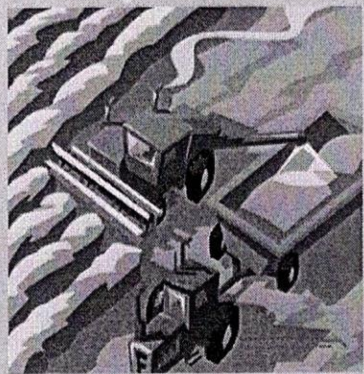
- TensorFlow:
  - Developed by Google
  - The most used deep learning framework
  - Based on Github stars and forks and Stack Overflow activity
- Caffe:
  - Developed by Berkeley Vision and Learning Center (BVLC)
  - Popular for CNN modeling (imaging/computer vision applications) and its Model Zoo (a selection of pre-trained networks)

Next to all these frameworks, there are also interfaces that are wrapped around one or multiple frameworks. The most well-known and widely-used interface for deep learning today is Keras. Keras is a high-level deep learning API, written in Python.

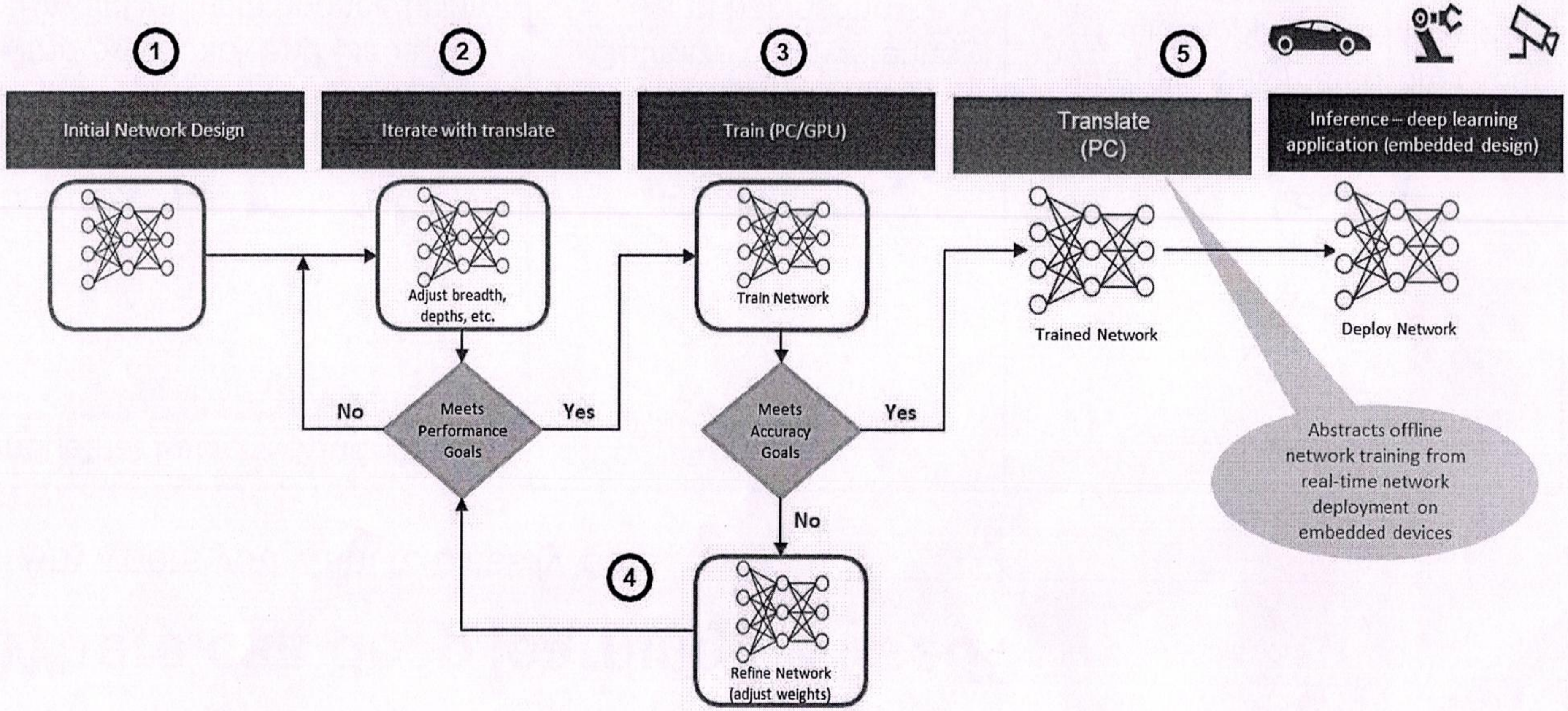
K Keras

Where can deep learning be used?

Anywhere you want to classify data ...

Industrial Factory & Automation	Agriculture	Retail
		
• Improving pick and place • Predictive maintenance/failure	Optimize crop watering and harvesting	• Improve automated checkout • Track shoppers and provide incentives

Deep learning development flow



Introduction to deep learning summary

- What is deep learning? Artificial intelligence, or AI, is an umbrella term for any computer program that does something smart. Machine learning is a subset of AI and Deep Learning is subset of Machine Learning.
- Deep learning has its roots in neural networks.
- Neural networks are sets of algorithms, modeled loosely after the human brain, that are designed to recognize patterns.
- Speaking deep learning: Network types, nodes, layers, development frameworks and network models.
- Deep learning solution development flow
- Application spaces

Deep learning: A few example uses

Industrial
- Object detection and localization
- Sorting
- Robotics
- Quality control and inspection
- AR (camera pose and location)
- Packaging

Retail
- Analytics
- Warehouse management
- Theft prevention
- Intelligent bar code scanners
- Monitoring and distribution control (shelf replenishment, etc.)

Entertainment/Gaming
- Gesture recognition
- User identification
- Emotional feedback
- Experience monitoring
- Advanced analytics

Smart Homes
- Vacuum cleaners
- Automatic lawn mowers
- Intrusion and Hazard detection
- Smart lights, ovens, refrigerators, etc.

Drones
- Obstacle avoidance
- Path planning
- Flight control with radar and camera sensors

Agriculture
- Autonomous tractors and combines
- Fruit harvesting
- Weed control

Smart Cities & Infrastructure
- Parking
- Traffic monitoring
- Security monitoring
- Road inspection

Food Industry
- Sorting
- Quality control

Mission Critical
- Perimeter surveillance
- Target acquisition
- Fire-and-forget guidance
- Autonomous vehicles

RECALL: LOGISTIC REGRESSION

Outline

- Logistic Regression (Recap)
- Neural Networks
- Backpropagation

Introducing popular open source libraries:

There are many open-source libraries that allow the creation of deep neural nets in Python, without having to explicitly write the code from scratch. In this book, we'll use three of the most popular: - TensorFlow, Keras, and PyTorch. They all share some common features, as follows:

The basic unit for data storage is the **tensor**. Consider the tensor as a generalization of a matrix to higher dimensions. Mathematically, the definition of a tensor is more complex, but in the context of deep learning libraries, they are multi-dimensional arrays of base values. A tensor is similar to a NumPy array and is made up of the following: A basic data type of tensor elements. These can vary between libraries, but typically include 16-, 32-, and 64-bit float and 8-, 16-, 32-, and 64-bit integers.

An arbitrary number of axes (also known as the rank, order, or degree of the tensor).An 0D tensor is just a scalar value, 1D is a vector, 2D is a matrix, and so on. In deep networks, the data is propagated in batches of *n* samples. This is done for performance reasons, but it also suits the notion of stochastic gradient descent. For example, if the input data is one-dimensional, such as [0, 1], [1, 0], [0, 0], and [1, 1] for XOR values, we'll actually work with a 2D tensor [[0, 1], [1, 0], [0, 0], [1, 1]] to represent all of the samples in a single batch. Alternatively, two-dimensional grayscale images will be represented as a three-dimensional tensor. In the context of deep learning libraries, the first axis of the tensor represents the different samples. A shape that is the size (the number of values) of each axis of the tensor. For example, the XOR tensor from the preceding example will have a shape of (4, 2). A tensor representing a batch of 32 128x128 images will have a shape of (32, 128, 128). Neural networks are represented as a **computational graph** of operations. The nodes of the graph represent the operations (weighted sum, activation function, and so on). The edges represent the flow of data, which is how the output of one operation serves as an input for the next one. The inputs and outputs of the operations (including the network inputs and outputs) are tensors. All libraries include **automatic differentiation**. This means, that all you need to do is define the network architecture and activation functions, and the library will automatically figure out all of the derivatives required for training with backpropagation. All libraries use Python. Until now, we've referred to GPUs in general, but in reality, the vast majority of deep learning projects work exclusively with NVIDIA GPUs. This is so because of the better software support NVIDIA provides. These libraries are no exception – to implement GPU operations, they rely on the CUDA toolkit in combination with the cuDNN library. cuDNN is an extension of CUDA, built specifically for deep learning applications. As was previously mentioned in the *Applications of deep learning* section, you can also run your deep learning experiments in the cloud.

For these libraries, we will quickly describe how to switch between a GPU and a CPU. Much of the code in this book can then be run on a CPU or a GPU, depending on the hardware available to the reader.

TensorFlow

TensorFlow(TF) (https://www.tensorflow.org), is the most popular deep learning library. It's developed and maintained by Google. You don't need to explicitly require the use of a GPU; rather TensorFlow will automatically try to use it if you have one. If you have more than one GPU, you must assign operations to each GPU explicitly, or only the first one will be used. To do this, you simply need to type the line that is show in the following code block: with tensorflow.device("/gpu:1"): # model definition here Here's an example: "/cpu:0": the main CPU of your machine "/gpu:0": the first GPU of your machine, if one exists "/gpu:1": the second GPU of your machine, if a second exists "/gpu:2": the third GPU of your machine, if a third exists, and so on TensorFlow has a steeper learning curve, compared to the other libraries. You can refer to the TensorFlow documentation to learn how to use it.

Keras

Kerasis a high-level neural net Python library that runs on top of **TensorFlow, CNTK** (https://github.com/Microsoft/CNTK), or **Theano**. For the purposes of this book, we'll assume that it uses TensorFlow on the backend. With **Keras,** you can perform rapid experimentation and it's relatively easy to use compared to TF. It will automatically detect an available GPU and attempt to use it. Otherwise, it will revert to the CPU. If you wish to specify the device manually, you can import **TensorFlow** and use the same code as in the previous section, *TensorFlow*: with tensorflow.device("/gpu:1"): # Keras model definition here Once again, you can refer to the online documentation for further information at http://keras.io.

PyTorch PyTorch(https://pytorch.org/) is a deep learning library based on Torch and developed by Facebook. It is relatively easy to use, and has recently gained a lot of popularity. It will automatically select a GPU, if one is available, reverting to the CPU otherwise. If you wish to select the device explicitly, you could use the following code sample: # at beginning of the script device = torch.device("cuda:0" if torch.cuda.is_available() else "cpu") ... # then whenever you get a new Tensor or Module # this won't copy if they are already on the desired device input = data.to(device) model = MyModule(...).to(device)

Using Keras to classify handwritten digits I

n this section, we'll use Keras to classify the images of the MNIST dataset. It's comprised of 70,000 examples of handwritten digits by different people. The first 60,000 are typically used for raining and the remaining 10,000 for testing: One of the advantages of Keras is that it can import his dataset for you without needing to explicitly download it from the web (it will download it for you):

1. Our first step will be to download the datasets using Keras: from keras.datasets import mnist.

2. Then, we need to import a few classes to use a feed-forward network: from keras.models import Sequential from keras.layers.core import Dense, Activation from keras.utils import np_utils.

3. Next, we'll load the training and testing data. (X_train, Y_train) are the training images and labels, and (X_test, Y_test) are the test images and labels: (X_train, Y_train), (X_test, Y_test) = mnist.load_data().

4. We need to modify the data to be able to use it. X_train contains 60,000 28 x 28 pixel images, and X_test contains 10,000. To feed them to the network as inputs, we want to reshape each sample as a 784-pixel long array, rather than a (28,28) two-dimensional matrix. We can accomplish this with these two lines: X_train = X_train.reshape(60000, 784) X_test = X_test.reshape(10000, 784).

5. The labels indicate the value of the digit depicted in the images. We want to convert this into a 10-entry **one-hot encoded** vector comprised of zeroes and just one 1 in the entry corresponding to the digit. For example, 4 is mapped to [0, 0, 0, 0, 1, 0, 0, 0, 0, 0]. Conversely, our network will have 10 output neurons: classes = 10 Y_train = np_utils.to_categorical(Y_train, classes) Y_test = np_utils.to_categorical(Y_test, classes).

6. Before calling our main function, we need to set the size of the input layer (the size of the MNIST images), the number of hidden neurons, the number of epochs to train the network, and the mini batch size: input_size = 784 batch_size = 100 hidden_neurons = 100 epochs = 100

7. We are ready to define our network. In this case, we'll use the Sequential model, where each layer serves as an input to the next. In Keras, Dense means fully-connected layer. We'll use a network with one hidden layer, sigmoid activation, and softmax output: model = Sequential([Dense(hidden_neurons, input_dim=input_size), Activation('sigmoid'), Dense(classes), Activation('softmax')]).

8. Keras now provides a simple way to specify the cost function (the loss) and its optimization, in this case, **cross-entropy** and stochastic gradient descent. We'll use the default values for learning rate, momentum, and so on: model.compile(loss='categorical_crossentropy', metrics=['accuracy'], optimizer='sgd').

Softmax and cross-entropy:

In the *Logistic regression* section of Chapter 2, *Neural Networks,* we learned how to apply regression to binary classification (two classes) problems. The softmax function is a generalization of this concept for multiple classes. Let's look at the following formula: Here, *i, j = 0, 1, 2, ... n* and *xi* represent each of *n*arbitrary real values, corresponding to *n* mutually exclusive classes. The softmax "squashes" the input values in the (0, 1) interval, similar to the logistic function. But it has the additional property that the sum of all the squashed outputs adds up to 1. We can interpret the softmax outputs as a normalized probability distribution of the classes. Then, it makes sense to use a loss function, which compares the difference between the estimated class probabilities and the actual class distribution (the difference is known as crossentropy). As we mentioned in step 5 of this section, the actual distribution is usually a one-hot-encoded vector, where the real class has a probability of 1, and all others have a probability of 0. The loss function that does this is called cross-entropy loss: Here, qi(x) is the estimated probability of the output to belong to class i(out of n total classes) and pi(x) is the actual probability. When we use one-hot-encoded target values for pi(x), only the target class has a nonzero value (1) and all others are zeros. In this case, cross entropy loss will only capture the error on the target class and will discard all their errors. For the sake of simplicity, we'll assume that we apply the formula over a single training sample.

9. We are ready to train the network. In Keras, we can do this in a simple way, with the fit method:

```
model.fit(X_train, Y_train, batch_size=batch_size, nb_epoch=epochs,
verbose=1)
```

10. All that's left to do is to add code to evaluate the network accuracy on the test data:

```
score = model.evaluate(X_test, Y_test, verbose=1) print('Test accuracy:', score[1])
```

And that's it. The test accuracy will be about 96%, which is not a great result, but this example runs in less than 30 seconds on a CPU. We can make some simple improvements, such as a larger number of hidden neurons, or a higher number of epochs. We'll leave those experiments to you, to familiarize yourself with the code. 11. To see what the network has learned, we can visualize the weights of the hidden layer. The following code allows us to obtain them:

```
weights = model.layers[0].get_weights()
```

12. To do this, we'll reshape the weights for each neuron back to a 28x28 twodimensional array:

```
import matplotlib.pyplot as plt
import matplotlib.cm as cm
import numpy
fig = plt.figure()
w = weights[0].T
for neuron in range(hidden_neurons):
ax = fig.add_subplot(10, 10, neuron + 1)
ax.axis("off")
ax.imshow(numpy.reshape(w[neuron], (28, 28)), cmap=cm.Greys_r)
plt.savefig("neuron_images.png", dpi=300)
plt.show()
```

Using Keras to classify images of objects With Keras, it's easy to create neural nets, but it's also easy to download test datasets. Let's try to use the CIFAR-10 (Canadian Institute For Advanced Research, https://www.cs. toronto.edu/~kriz/cifar.html) dataset instead of MNIST. It consists of 60,000 32x32 RGB images, divided into 10 classes of objects, namely: airplanes, automobiles, birds, cats, deers, dogs, frogs, horses, ships, and trucks:

1. We'll import CIFAR-10 in the same way as we did MNIST: from keras.datasets import cifar10 from keras.layers.core import Dense, Activation from keras.models import Sequential from keras.utils import np_utils.

2. Then, we'll split the data into 50,000 training images and 10,000 testing images. Once again, we need to reshape the image to a one-dimensional array. In this case, each image has 3 color channels (red, green, and blue) of 32x32 pixels, hence 3 x32x3 = 3072:

```
(X_train, Y_train), (X_test, Y_test) = cifar10.load_data()
X_train = X_train.reshape(50000, 3072)
X_test = X_test.reshape(10000, 3072)
classes = 10
Y_train = np_utils.to_categorical(Y_train, classes)
Y_test = np_utils.to_categorical(Y_test, classes)
input_size = 3072
batch_size = 100
epochs = 100
```

3. This dataset is more complex than MNIST and the network has to reflect that. Let's try to use a network with three hidden layers and more hidden neurons than the previous example:

```
model = Sequential([
Dense(1024, input_dim=input_size),
Activation('relu'),
Dense(512),
Activation('relu'),
Dense(512),
Activation('sigmoid'),
Dense(classes),
Activation('softmax')
])
```

4. We'll run the training with one additional parameter, validation_data=(X_test, Y_test), which will use the test data as a validation set:

```
model.compile(loss='categorical_crossentropy',
metrics=['accuracy'], optimizer='sgd')
model.fit(X_train, Y_train, batch_size=batch_size, epochs=epochs,
validation_data=(X_test, Y_test), verbose=1)
```

5. Next, we'll visualize the weights of 100 random neurons from the first layer. We'll reshape the weights to 32x32 arrays and we'll compute the mean value of the 3 color channels to produce a grayscale image:

```
import matplotlib.pyplot as plt
import matplotlib.cm as cm
import matplotlib.gridspec as gridspec
```

```
import numpy
import random
fig = plt.figure()
outer_grid = gridspec.GridSpec(10, 10, wspace=0.0, hspace=0.0)
weights = model.layers[0].get_weights()
w = weights[0].T
for i, neuron in enumerate(random.sample(range(0, 1023), 100)):
ax = plt.Subplot(fig, outer_grid[i])
ax.imshow(numpy.mean(numpy.reshape(w[i], (32, 32, 3)), axis=2),
cmap=cm.Greys_r)
ax.set_xticks([])
ax.set_yticks([])
fig.add_subplot(ax)
plt.show()
```

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS

KADAPA , AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. Bayyarapu. Suresh

Bearing the Roll No 179Y1A0422

has Succesfully completed certification course on

Deep learning using python

From 05/10/2020 *to* 20/10/2020 *, Organized by Department of*

Electronics and Communication Engineering

Coordinator

Head Of Department

V. S. S. Murthy

Principal

LIGHTED TO LIGHTEN

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS

KADAPA, AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. Erigela. Mounika

Bearing the Roll No 179Y1A0440

has Succesfully completed certification course on

Deep learning using python

From 05/10/2020 ***to*** 20/10/2020 ***, Organized by Department of*** Electronics and Communication Engineering.

Coordinator

Head Of Department

V. S. S. Murthy

Principal

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS
KADAPA, AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. Ambati. Gurusiva

Bearing the Roll No 179Y1A0403

has Succesfully completed certification course on

Deep learning using python

From 5/10/2020 *to* 20/10/2020 *, Organized by Department of*

Electronics and Communication Engineering

Coordinator

Head Of Department

V. S. S. Murthy

Principal

K.S.R.M. COLLEGE OF ENGINEERING

(UGC - AUTONOMOUS)

Kadapa, Andhra Pradesh, India - 516003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

Department of Electronics and Communication Engineering

Feedback Form

S.No.	Email address	Name of the student	Year & Semester	Branch	Roll Num	Is the course content met your expectation	Is the lecture sequence well planned	The contents of the course is explained with examples	Is the level of course high	Is the course exposed you to the new knowledge and practices	Is the lecturer clear and easy to understand	Rate the value of course in increasing your skills	Any issues
1	179Y1A0401@ksrmce.ac.in	ADURI VISHNU VARDHAN REDDY	B.Tech VIIsem	ECE	179Y1A0401	Yes	Yes	Agree	Agree	Strongly agree	4	5	Nothing
2	179Y1A0402@ksrmce.ac.in	ALA LAKSHMI SAI GOWRI (W)	B.Tech VIIsem	ECE	179Y1A0402	Yes	Yes	Agree	Agree	Strongly agree	5	5	Nothing
3	179Y1A0403@ksrmce.ac.in	AMBATI GURUSIVA	B.Tech VIIsem	ECE	179Y1A0403	Yes	Yes	Agree	Agree	Strongly agree	4	5	Good
4	179Y1A0404@ksrmce.ac.in	AMBATI LAKSHUMAIAH	B.Tech VIIsem	ECE	179Y1A0404	Yes	Yes	Agree	Agree	Strongly agree	5	5	nothing
5	179Y1A0405@ksrmce.ac.in	ANDELA MATAM VINAY KUMAR	B.Tech VIIsem	ECE	179Y1A0405	Yes	Yes	Agree	Agree	Strongly agree	5	5	Good
6	179Y1A0406@ksrmce.ac.in	ANKANA SUNITHA (W)	B.Tech VIIsem	ECE	179Y1A0406	Yes	Yes	Agree	Agree	Strongly agree	4	5	very good
7	179Y1A0407@ksrmce.ac.in	ANNAREDDY VENKATA MEGHANA(W)	B.Tech VIIsem	ECE	179Y1A0407	Yes	Yes	Strongly agree	Agree	Strongly agree	4	3	Nothing
8	179Y1A0408@ksrmce.ac.in	ANUGURU VINEELA (W)	B.Tech VIIsem	ECE	179Y1A0408	Yes	Yes	agree	Agree	Strongly agree	4	4	no
9	179Y1A0409@ksrmce.ac.in	ATHIKARI PRATHYUSHA (W)	B.Tech VIIsem	ECE	179Y1A0409	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Nothing
10	179Y1A0410@ksrmce.ac.in	AVINASH, B	B.Tech VIIsem	ECE	179Y1A0410	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good

11	179Y1A0411@ksrmce.ac.in	AVULA VAMSIKRISHNA	B.Tech VIIsem	ECE	179Y1A0411	Yes	Yes	Agree	Agree	Strongly agree	5	4	Good
12	179Y1A0412@ksrmce.ac.in	B BABU PRASAD	B.Tech VIIsem	ECE	179Y1A0412	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
13	179Y1A0413@ksrmce.ac.in	BALAM SAINATH	B.Tech VIIsem	ECE	179Y1A0413	Yes	Yes	agree	Agree	Strongly agree	3	5	Good
14	179Y1A0414@ksrmce.ac.in	BALARAMIREDDYGARI BHARATH KALYAN	B.Tech VIIsem	ECE	179Y1A0414	Yes	Yes	agree	Agree	Strongly agree	5	4	very good
15	179Y1A0416@ksrmce.ac.in	BANDI NAVEEN KUMAR	B.Tech VIIsem	ECE	179Y1A0416	Yes	Yes	agree	Agree	Strongly agree	4	4	very good
16	179Y1A0417@ksrmce.ac.in	BANDI NIKHIL KUMAR	B.Tech VIIsem	ECE	179Y1A0417	Yes	Yes	agree	Agree	Strongly agree	5	4	very good
17	179Y1A0418@ksrmce.ac.in	BANDI PRANEETH	B.Tech VIIsem	ECE	179Y1A0418	Yes	Yes	agree	Agree	Strongly agree	3	5	no
18	179Y1A0419@ksrmce.ac.in	BANTHULLA ANIL KUMAR RAJU	B.Tech VIIsem	ECE	179Y1A0419	Yes	Yes	agree	Agree	Strongly agree	4	5	nithing
19	179Y1A0420@ksrmce.ac.in	BASIREDDY MAHESH KUMAR REDDY	B.Tech VIIsem	ECE	179Y1A0420	Yes	Yes	Strongly agree	Agree	Strongly agree	4	5	Good
20	179Y1A0421@ksrmce.ac.in	BATHALA MANOJ	B.Tech VIIsem	ECE	179Y1A0421	Yes	Yes	Strongly agree	Agree	Strongly agree	4	4	Good
21	179Y1A0422@ksrmce.ac.in	BAYYARAPU SURESH	B.Tech VIIsem	ECE	179Y1A0422	Yes	Yes	Strongly agree	Agree	Strongly agree	4	3	Good
22	179Y1A0423@ksrmce.ac.in	BHEEMAVARAPU VARA LAKSHMI (W)	B.Tech VIIsem	ECE	179Y1A0423	Yes	Yes	agree	Agree	Strongly agree	4	4	Good
23	179Y1A0424@ksrmce.ac.in	BHUMIREDDY KUNTOLLA SURESH	B.Tech VIIsem	ECE	179Y1A0424	Yes	Yes	agree	Agree	Strongly agree	5	4	Good
24	179Y1A0425@ksrmce.ac.in	BOYA GUNASEKHAR	B.Tech VIIsem	ECE	179Y1A0425	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	Good
25	179Y1A0426@ksrmce.ac.in	BUKKEY RAKESH NAIK	B.Tech VIIsem	ECE	179Y1A0426	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
26	179Y1A0427@ksrmce.ac.in	CHAGALETI SURYA NARAYANA REDDY	B.Tech VIIsem	ECE	179Y1A0427	Yes	Yes	agree	Agree	Strongly agree	5	5	Nothing
27	179Y1A0428@ksrmce.ac.in	CHAMARTHI SANJEEVARAJU	B.Tech VIIsem	ECE	179Y1A0428	Yes	Yes	agree	Agree	Strongly agree	5	5	no
28	179Y1A0429@ksrmce.ac.in	CHAVVA JASWITHA (W)	B.Tech VIIsem	ECE	179Y1A0429	Yes	Yes	agree	Agree	Strongly agree	3	4	no

29	179Y1A0431@ksrmce.ac.in	CHILLA VENKATESWARA REDDY	B.Tech VIIsem	ECE	179Y1A0431	Yes	Yes	Strongly agree	Agree	Strongly agree	3	4	no
30	179Y1A0432@ksrmce.ac.in	CHILLATHOTI KEERTHI (W)	B.Tech VIIsem	ECE	179Y1A0432	Yes	Yes	Strongly agree	Agree	Strongly agree		5	no
31	179Y1A0433@ksrmce.ac.in	DADIBOYINA LOHITHA (W)	B.Tech VIIsem	ECE	179Y1A0433	Yes	Yes	Strongly agree	Agree	Strongly agree	5	4	nothing
32	179Y1A0434@ksrmce.ac.in	DANDEBOYINA NAVYA SREE (W)	B.Tech VIIsem	ECE	179Y1A0434	Yes	Yes	agree	Agree	Strongly agree	5	5	Nothing
33	179Y1A0435@ksrmce.ac.in	DARA SEKHAR	B.Tech VIIsem	ECE	179Y1A0435	Yes	Yes	agree	Agree	Strongly agree	5	4	no
34	179Y1A0436@ksrmce.ac.in	DEVAGUDI VENKATA SUBBAIAH	B.Tech VIIsem	ECE	179Y1A0436	Yes	Yes	agree	Agree	Strongly agree	5	4	Nothing
35	179Y1A0437@ksrmce.ac.in	DOKKUPALLI RAJESH KUMAR REDDY	B.Tech VIIsem	ECE	179Y1A0437	Yes	Yes	agree	Agree	Strongly agree	5	4	Good
36	179Y1A0438@ksrmce.ac.in	DOMMARAJU RAM MOHAN RAJU	B.Tech VIIsem	ECE	179Y1A0438	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
37	179Y1A0439@ksrmce.ac.in	DUGGIREDDY VENKATA THARUN KUMAR	B.Tech VIIsem	ECE	179Y1A0439	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
38	179Y1A0440@ksrmce.ac.in	ERIGELA MOUNIKA (W)	B.Tech VIIsem	ECE	179Y1A0440	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
39	179Y1A0441@ksrmce.ac.in	ETHAKOTI RAJESH	B.Tech VIIsem	ECE	179Y1A0441	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
40	179Y1A0442@ksrmce.ac.in	G B SIDDA UMA MAHESWARA REDDY	B.Tech VIIsem	ECE	179Y1A0442	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	Good
41	179Y1A0443@ksrmce.ac.in	GAJJALA DIVYA	B.Tech VIIsem	ECE	179Y1A0443	Yes	Yes	agree	Agree	Strongly agree	4	4	Good
42	179Y1A0445@ksrmce.ac.in	GAJJALA VENKATA ROHITHKUMAR REDDY	B.Tech VIIsem	ECE	179Y1A0445	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
43	179Y1A0446@ksrmce.ac.in	GAJULAPALLI VENKATAPRASANNA (W)	B.Tech VIIsem	ECE	179Y1A0446	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
44	199YIA0447@ksrmce.ac.in	GALIGUTTA VIDYA (W)	B.Tech VIIsem	ECE	179Y1A0447	Yes	Yes	agree	Agree	Strongly agree	3	5	Good
45	179Y1A0448@ksrmce.ac.in	GANDHAM ARAVINDA SAI	B.Tech VIIsem	ECE	179Y1A0448	Yes	Yes	agree	Agree	Strongly agree	3	5	Nothing
46	179Y1A0449@ksrmce.ac.in	GANGARAPU MYTHRI (W)	B.Tech VIIsem	ECE	179Y1A0449	Yes	Yes	Strongly agree	Agree	Strongly agree	2	5	Nothing

47	179Y1A0452@ksrmce.ac.in	GOPARAJULU RENUKA HARSHITHA (W)	B.Tech VIIsem	ECE	179Y1A0452	Yes	Yes	agree	Agree	Strongly agree	2	5	very good
48	179Y1A0454@ksrmce.ac.in	GORLA SUSHMITHA REDDY (W)	B.Tech VIIsem	ECE	179Y1A0454	Yes	Yes	agree	Agree	Strongly agree	4	5	very good
49	179Y1A0455@ksrmce.ac.in	GUDURU HARIKRISHNA	B.Tech VIIsem	ECE	179Y1A0455	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	very good
50	179Y1A0456@ksrmce.ac.in	GUNDLADURTHI BALAYALLA REDDY	B.Tech VIIsem	ECE	179Y1A0456	Yes	Yes	Strongly agree	Agree	Strongly agree	4	5	nothing
51	179Y1A0457@ksrmce.ac.in	IDAGOTTU VENKATA SAI CHARAN	B.Tech VIIsem	ECE	179Y1A0457	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
52	179Y1A0458@ksrmce.ac.in	JULAKALVA NIRANJANAREDDY	B.Tech VIIsem	ECE	179Y1A0458	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
53	179Y1A0459@ksrmce.ac.in	KALLURU SUNANDHANA (W)	B.Tech VIIsem	ECE	179Y1A0459	Yes	Yes	agree	Agree	Strongly agree	4	5	nothing
54	179Y1A0460@ksrmce.ac.in	KAMBAM VASU KALYAN REDDY	B.Tech VIIsem	ECE	179Y1A0460	Yes	Yes	agree	Agree	Strongly agree	4	5	nothing
55	179Y1A0461@ksrmce.ac.in	KAMBELLA SAMBA	B.Tech VIIsem	ECE	179Y1A0461	Yes	Yes	agree	Agree	Strongly agree	4	5	nothing
56	179Y1A0463@ksrmce.ac.in	KANALA PRAMOD KUMAR REDDY	B.Tech VIIsem	ECE	179Y1A0463	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
57	179Y1A04A4@ksrmce.ac.in	PICHALA VINOD KUMAR REDDY	B.Tech VIIsem	ECE	179Y1A04A4	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
58	179Y1A04A5@ksrmce.ac.in	POGILI SIVALAHARI (W)	B.Tech VIIsem	ECE	179Y1A04A5	Yes	Yes	agree	Agree	Strongly agree	5	5	very good
59	179Y1A04A6@ksrmce.ac.in	POLEPALLI VIJAYA VANI (W)	B.Tech VIIsem	ECE	179Y1A04A6	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	very good
60	179Y1A04A8@ksrmce.ac.in	PULICHERLA YASWANTH REDDY	B.Tech VIIsem	ECE	179Y1A04A8	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	nothing
61	179Y1A04A9@ksrmce.ac.in	RAMACHANDRAPPA GARI BHARATH	B.Tech VIIsem	ECE	179Y1A04A9	Yes	Yes	agree	Agree	Strongly agree	5	5	no
62	179Y1A04B0@ksrmce.ac.in	RANADHIR REDDY U	B.Tech VIIsem	ECE	179Y1A04B0	Yes	Yes	agree	Agree	Strongly agree	5	5	Nothing
63	179Y1A04B1@ksrmce.ac.in	RANGAREDDIGARI NITHYA SREE (W)	B.Tech VIIsem	ECE	179Y1A04B1	Yes	Yes	agree	Agree	Strongly agree	3	4	no
64	179Y1A04B3@ksrmce.ac.in	RUDRARAJU CHARAN KUMAR RAJU	B.Tech VIIsem	ECE	179Y1A04B3	Yes	Yes	agree	Agree	Strongly agree	5	5	nothing

65	179Y1A04B4@ksrmce.ac.in	SAMPATHI REDDY ESWARSAI	B.Tech VIIsem	ECE	179Y1A04B4	Yes	Yes	agree	Agree	Strongly agree	5	5	Good
66	179Y1A04B5@ksrmce.ac.in	SETTIPALLI PAVAN KALYAN	B.Tech VIIsem	ECE	179Y1A04B5	Yes	Yes	agree	Agree	Strongly agree	5	4	Good
67	179Y1A04B6@ksrmce.ac.in	SHAIK ATHAR	B.Tech VIIsem	ECE	179Y1A04B6	Yes	Yes	agree	Agree	Strongly agree	4	5	Good
68	179Y1A04B7@ksrmce.ac.in	SHAIK FUZAIL	B.Tech VIIsem	ECE	179Y1A04B7	Yes	Yes	agree	Agree	Strongly agree	4	4	Good
69	179Y1A04B9@ksrmce.ac.in	SHAIK MOHAMMAD SHAKEER	B.Tech VIIsem	ECE	179Y1A04B9	Yes	Yes	Strongly agree	Agree	Strongly agree	4	5	very good
70	179Y1A04C0@ksrmce.ac.in	SHAIK MOHAMMED SHARIF	B.Tech VIIsem	ECE	179Y1A04C0	Yes	Yes	Strongly agree	Agree	Strongly agree	4	5	very good
71	179Y1A04C1@ksrmce.ac.in	SHAIK NOOR MOHAMMED	B.Tech VIIsem	ECE	179Y1A04C1	Yes	Yes	Strongly agree	Agree	Strongly agree	5	5	very good

Coordinator

HOD
Professor & H.O.D.
Department of E.C.E.
K.S.R.M. College of Engineering
KADAPA - 516 003.

V. S. S. Murthy
Principal
PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)