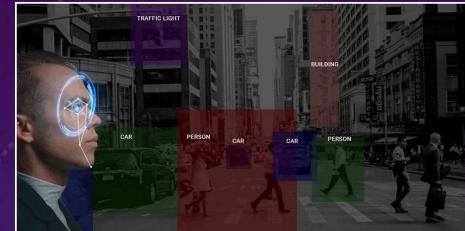


# DEEP LEARNING IN COMPUTER VISION APPLICATIONS & TIME SERIES ANALYSIS

14-Feb-2020

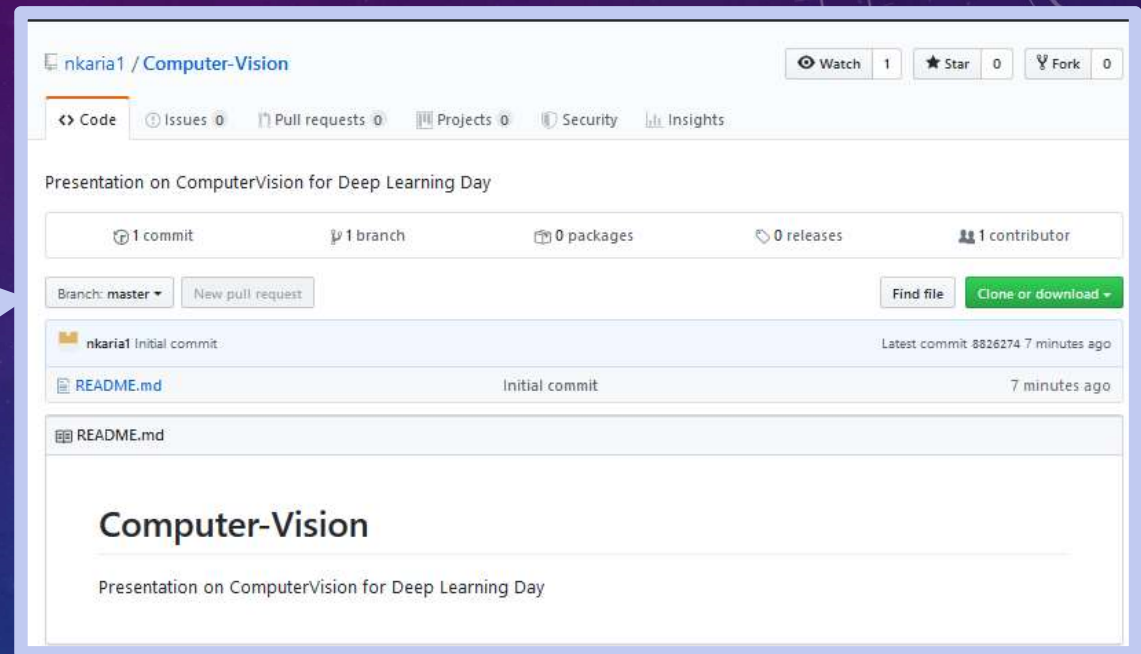


NIHARIKA KARIA

DATA SCIENTIST



# Cameras out



# Breaking Down Computer Vision Application

## 1. Input

- Photo sensor

## 2. Digitization

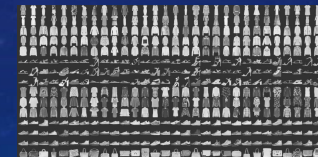
- Binary / Decimal

## 3. Transformation

Rule Based  
Computer Science Application



Example Based  
Machine Learning Application





# Computer Vision Applications

Computer Vision is a field of deep learning that enables machines to see, identify and process images like humans.

# Fiction in '90s is Fact Today

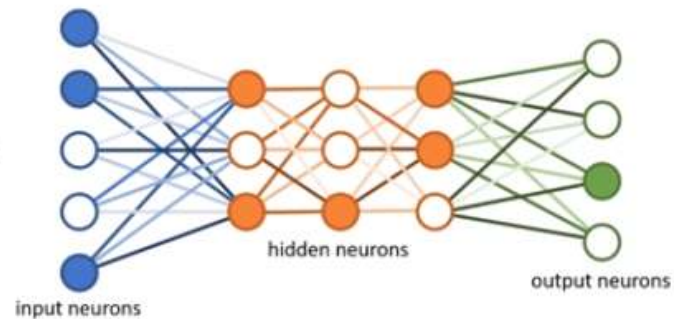
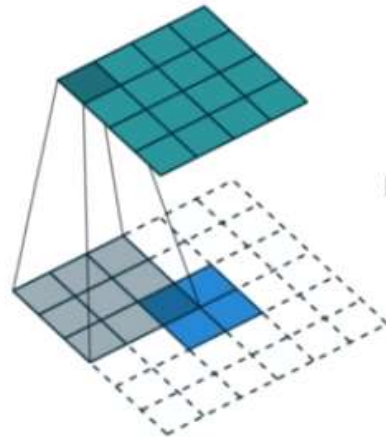


# Computer Vision Capabilities

- Identify
- Classify
- Measure
- Track
- Annotate

# Convolutional Neural Network

CNN = Convolution + Neural Networks





# Computer Vision For Identification

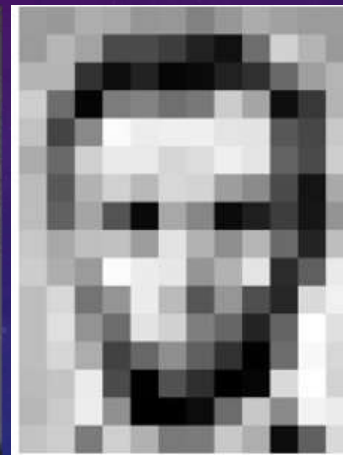
Grey scale



Convolution



Pooling



167	163	174	168	162	129	163	172	163	168	168
155	182	163	74	75	62	35	17	130	210	180
180	180	80	34	34	6	10	33	48	106	169
206	106	6	124	101	111	120	204	165	15	56
194	68	197	251	237	239	239	228	227	67	71
172	106	207	239	239	214	220	239	238	98	74
188	88	179	209	186	215	211	168	139	75	20
189	97	165	84	16	168	134	11	31	62	22
199	168	191	193	168	227	179	143	182	106	36
205	174	165	252	236	231	149	178	228	43	95
190	216	116	149	236	187	86	160	79	38	218
190	224	147	108	227	210	127	103	36	101	355
190	214	173	96	103	143	96	90	2	109	249
187	186	238	75	1	81	47	0	6	217	266
183	202	237	145	0	0	12	108	200	138	243
195	206	123	207	177	121	123	200	175	13	96

Flattening

167
155
180
206
194
172
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172
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189
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205
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190
190



# Convolution

1 <sub>x1</sub>	1 <sub>x0</sub>	1 <sub>x1</sub>	0	0
0 <sub>x0</sub>	1 <sub>x1</sub>	1 <sub>x0</sub>	1	0
0 <sub>x1</sub>	0 <sub>x0</sub>	1 <sub>x1</sub>	1	1
0	0	1	1	0
0	1	1	0	0

Image

4		

Convolved  
Feature

# Pooling

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

→  
Max  
pooling

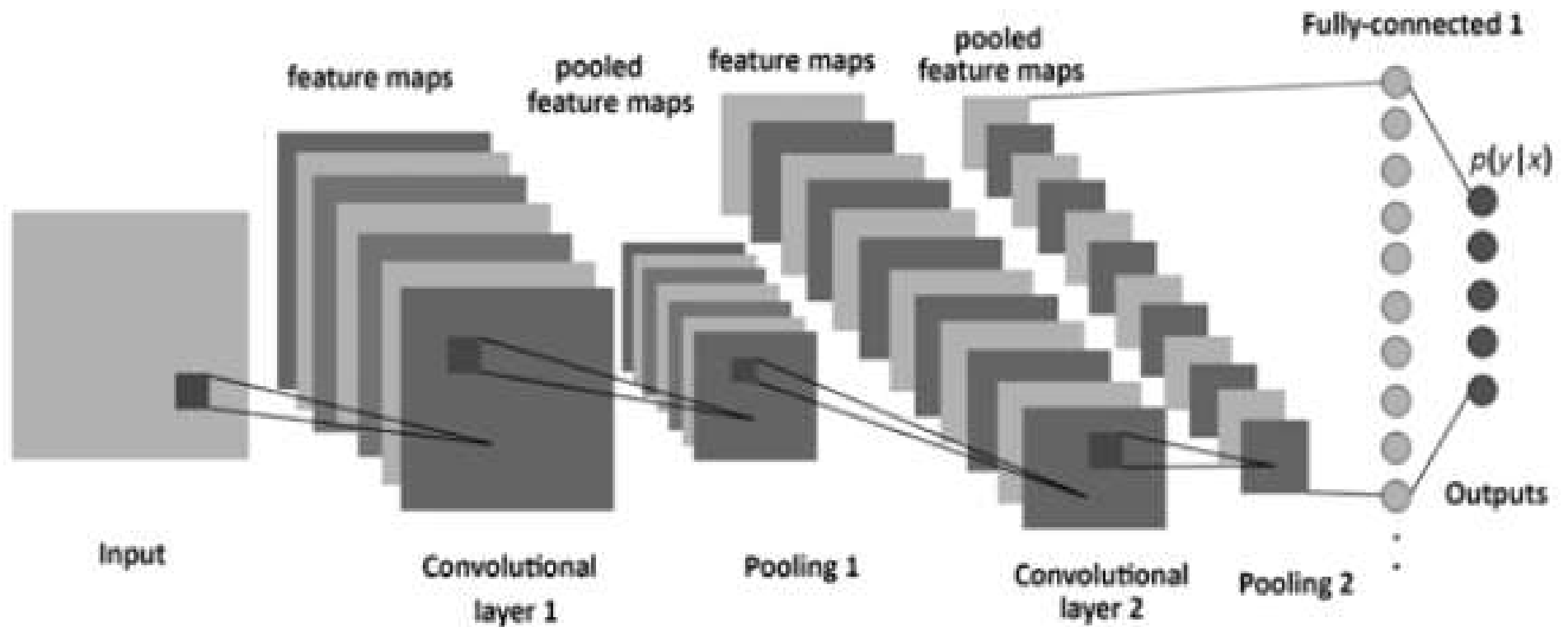
5	8
9	7

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

→  
Average  
pooling

2.5	4.25
3.5	3.75

# Bringing it all Together





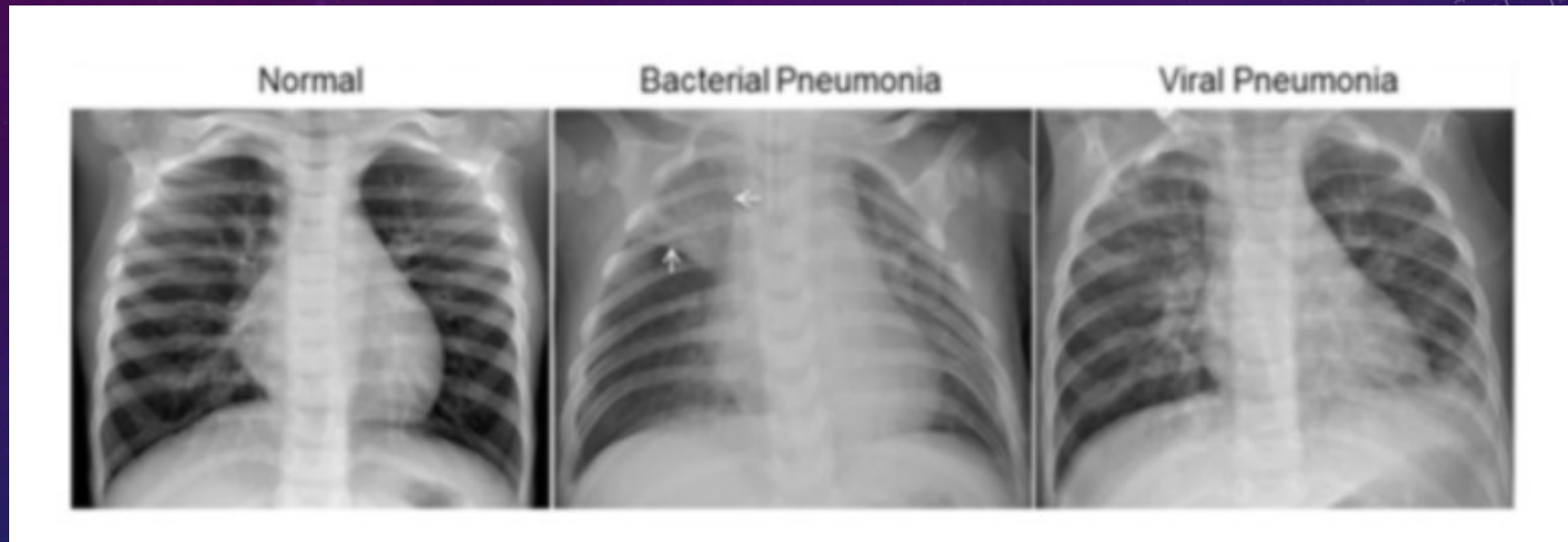
# The Building Blocks



The background is a dark blue gradient with a subtle pattern of white dots. On the left side, there are several concentric circles and a scale. The scale is a semi-circular arc with tick marks and numbers ranging from 140 to 260. There are also some dashed lines and arrows pointing in different directions, creating a technical or scientific feel.

# Jupyter Notebook Demo

# Medical Application

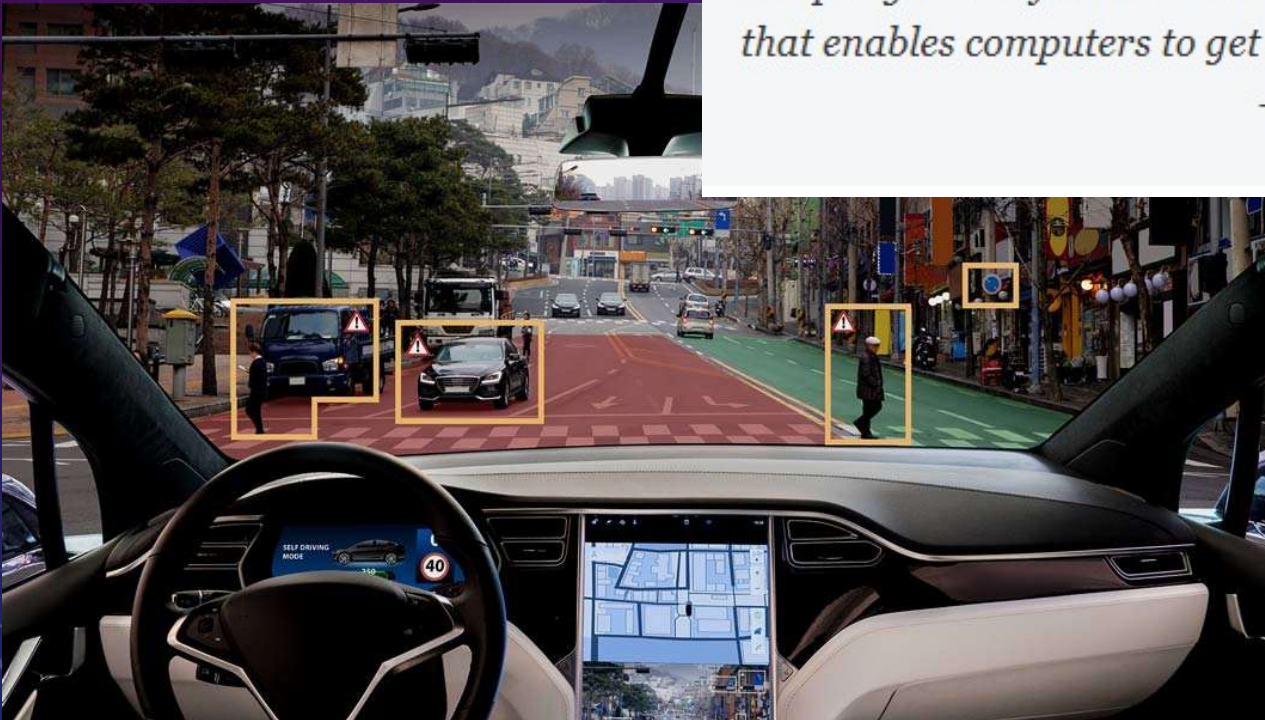




# Real Future is Machine Learning

*Google's self-driving cars and robots get a lot of press, but the company's real future is in machine learning, the technology that enables computers to get smarter and more personal.*

*– Eric Schmidt (Google Chairman)*

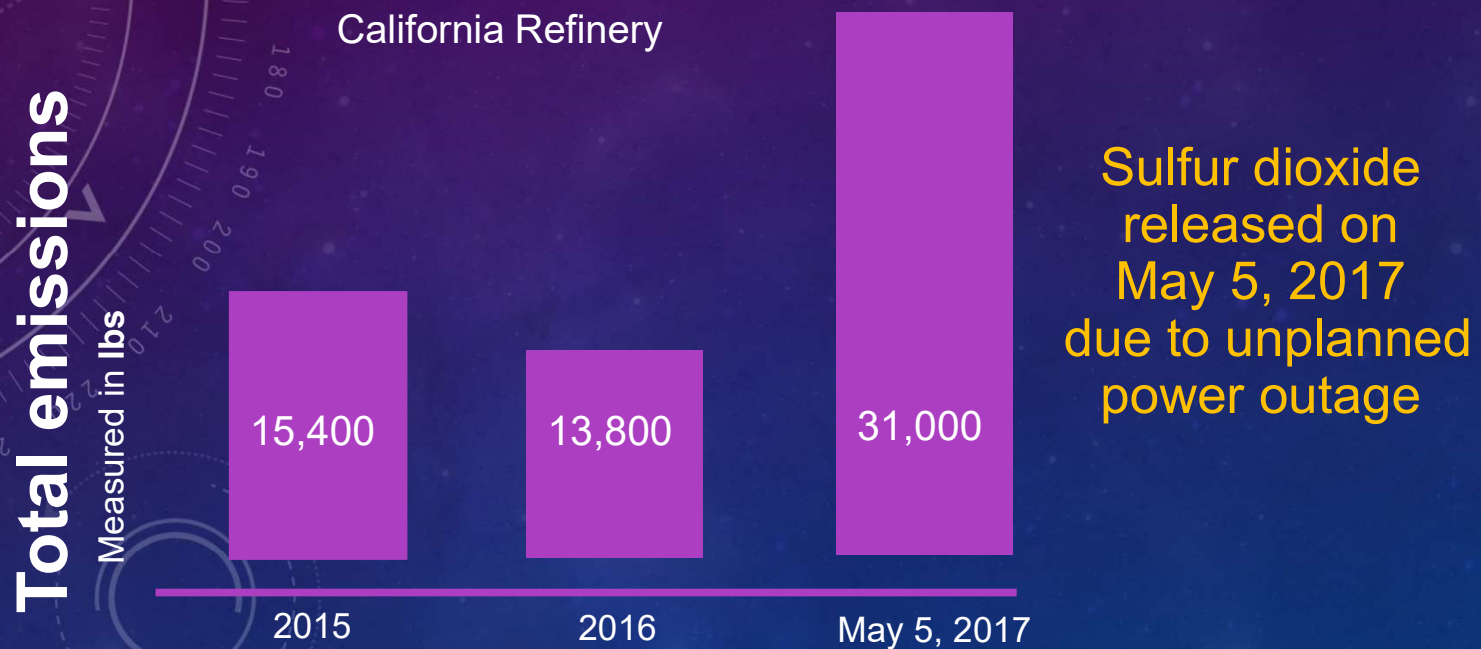


# Real Challenges





# Unplanned Downtime And The Environment





# Availability Losses in Refining



1700 shutdowns  
at refineries  
between  
2006 and 2017

46% were due to  
mechanical  
breakdown

*U.S. Department of Energy*

## Unplanned Shutdowns

cost oil and gas  
companies an average  
of **\$42 million a  
year** and up to \$88  
million a year in the  
worst case scenarios

*McKinsey*

# The Gap In Equipment Monitoring

85% equipment fails in spite  
of calendar maintenance - *Boeing*

63% scheduled maintenance  
is unnecessary — *Automation Vendor*

**The spend is in**  
wear-and-tear

**vs**

**The problem is**  
process-induced

# Equipment Monitoring with Machine Learning



More Time = Better Decisions



# Challenges With Time Series Data

Temporal correlations

Row order matters

Feature selection

Data Cleaning

Difficulty in visually identification

Model deterioration over time

# Challenges With Time Series Data



# Solutions to Questions of Process Engineers

When?

Why?

What?



has  
answers.





# Success Stories

A European petrochemical producer has used predictive analytics solution provided by Aspen to develop a data driven approach to maintenance planning. With the new plan in place, they eliminated two days of shutdown per year on each piece of equipment and saved \$1.8 million .

At a leading pulp and paper manufacturing site, Aspen Tech software alerted to a major fire with 9 days of advance warning which gave the operators an opportunity to take corrective actions to improved the safety.

A refinery with 300,000 barrels per day capacity has been able to predict failures with significant lead time, and has done so without false positives.

# Three Simultaneous Benefits



The diagram features three large green arrows arranged horizontally. The left arrow points upwards and contains the text 'Increase Safety'. The middle arrow points downwards and contains the text 'Reduce GHG Emissions'. The right arrow points upwards and contains the text 'Increase Asset Availability'. The background is a dark blue gradient with faint, stylized circular patterns and numerical scales.

Increase  
Safety

Reduce GHG  
Emissions

Increase Asset  
Availability

# Questions ?

FAQ:

Q: Can we get slides?

A: Yes, scan this code.



SCAN ME