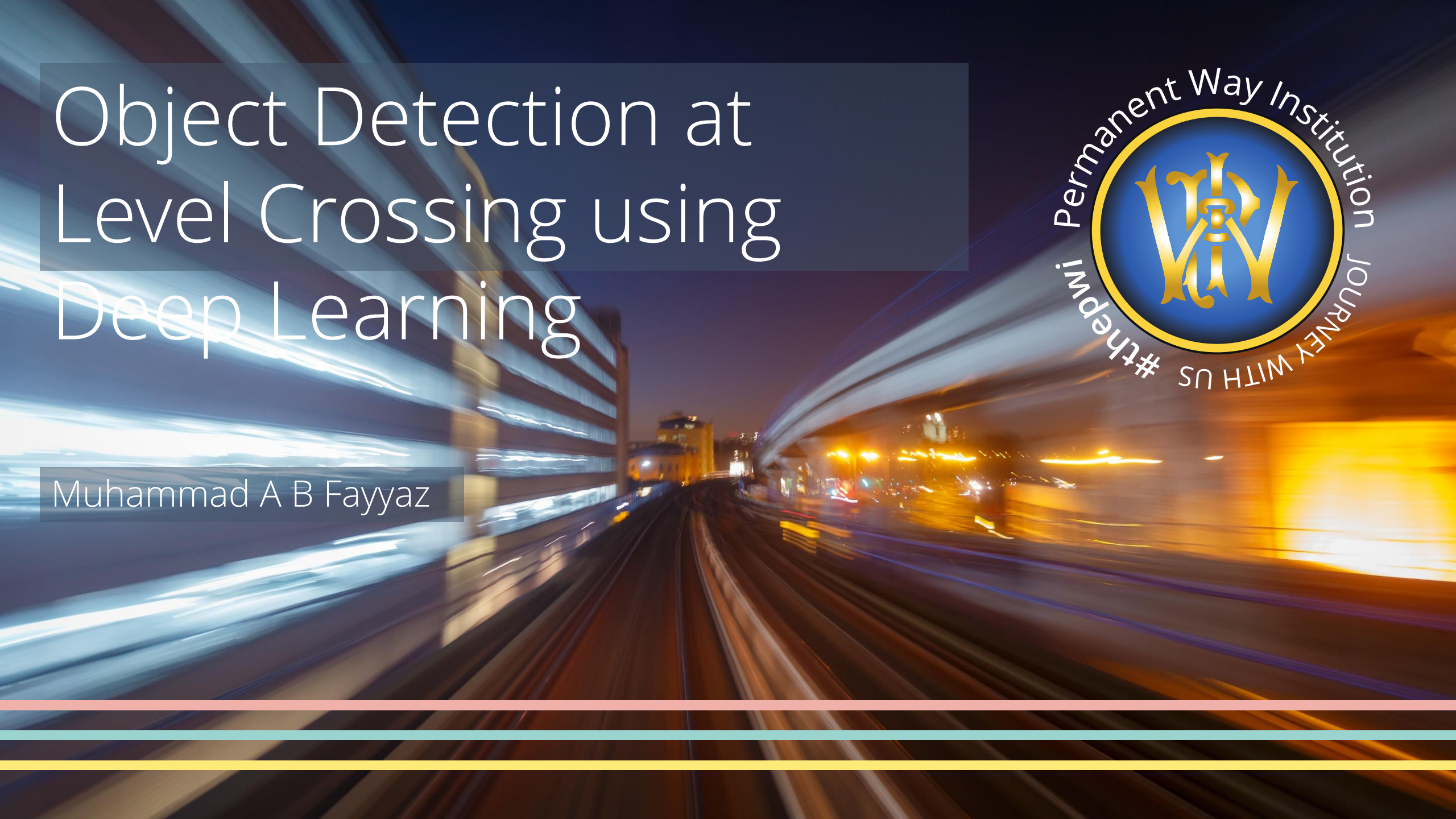
Object Detection at Level Crossing using Deep Learning

Muhammad A B Fayyaz



Picture courtesy: https://www.networkrail.co.uk/running-the-railway/looking-after-the-railway/level-crossings/

Picture Courtesy: Network Rail

	2014/15	2015/16	2016/17	2017/18	2018/19
Level crossing misuse (MAA) Network-wide	25.46	25.92	29.85	31.38	30.23
Collisions with road vehicles	7	4	6	7	9
Train striking pedestrian	12	5	11	7	3
Near miss with road vehicle	76	72	95	80	73
Near miss with non-vehicle users	236	256	276	314	308

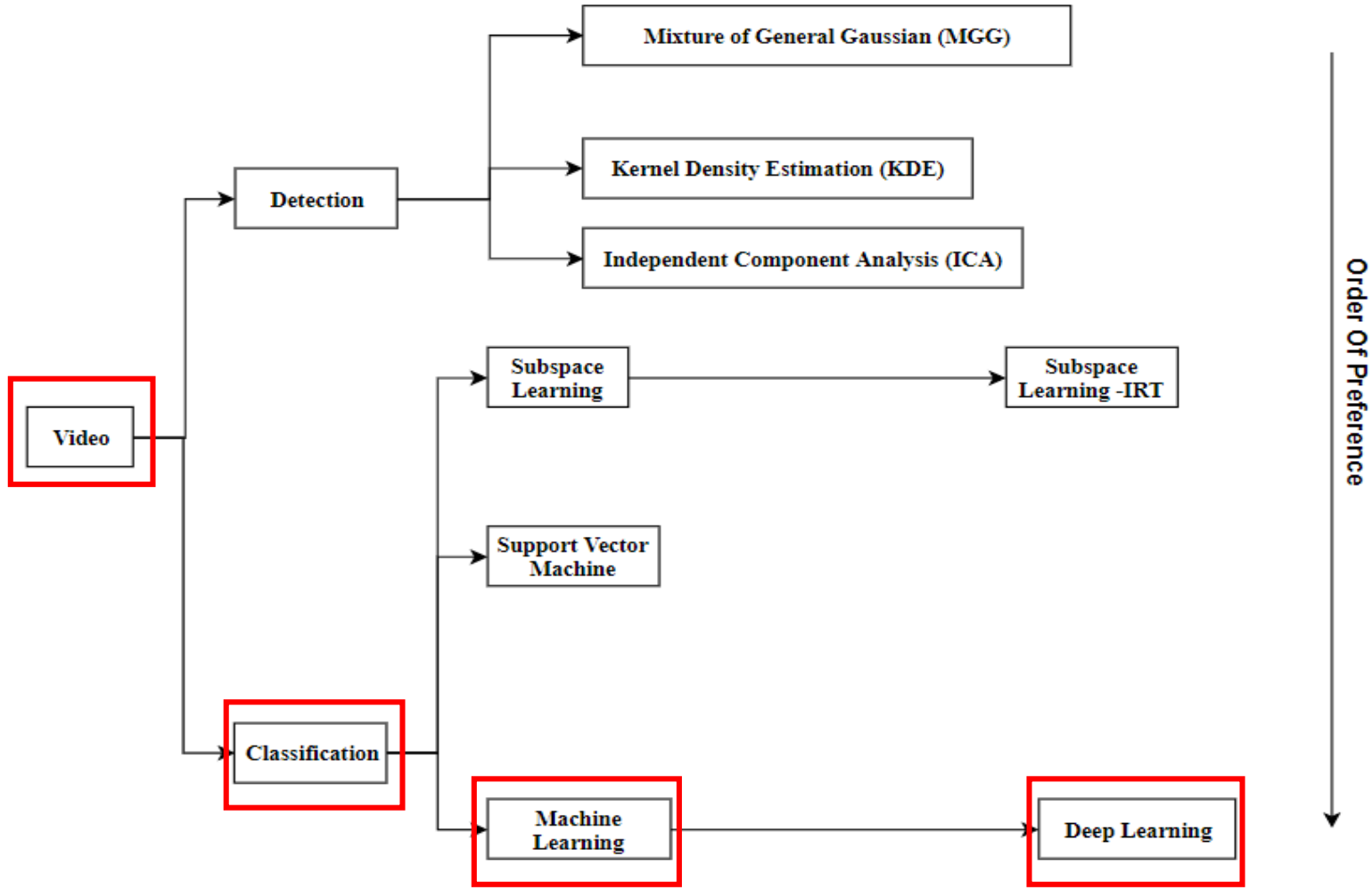
Picture Courtesy: Network Rail

	UK	Rest of Europe (RoE)	UK/RoE
LC user fatalities per year	6.4	294.6	
LC user fatalities per year per million population	0.098	0.580	0.170
LC user fatalities per year per thousand rail route-km	0.396	1.370	0.289
LC user fatalities per year per thousand LCs	1.015	2.715	0.374

“Level crossings provide communities with a convenient way to cross the railway, but do represent a risk to the people and vehicle occupants that use them, and to the railway itself”.

RSSB

	Equipment Cost	Maintenance	Product Life Cycle	False Positive	Impact on Weather
Inductive Loops	5	5	4	4	4
Strain Gauge/Piezometers	5	5	4	4	3
CCTV	2	3	2	3	3
Stereo Camera	3	4	2	3	3
Thermal Camera	4	2	2	2	2
SONAR	2	4	3	3	2
Millimeter-Wavelength Beam Interference	4	4	1	3	4
Laser Range Finder Beam (LRBF)	3	4	2	5	4
Light Detection and Ranging (LiDAR)	5	4	2	2	2
RADAR	3	2	1	1	2


Mixture of General Gaussian (MGG)
Kernel Density Estimation (KDE)
Independent Component Analysis (ICA)
Detection
Subspace Learning
Subspace Learning -IRT
Video
Support Vector Machine
Classification
Machine Learning
Deep Learning
Order Of Preference

Artificial Intelligence

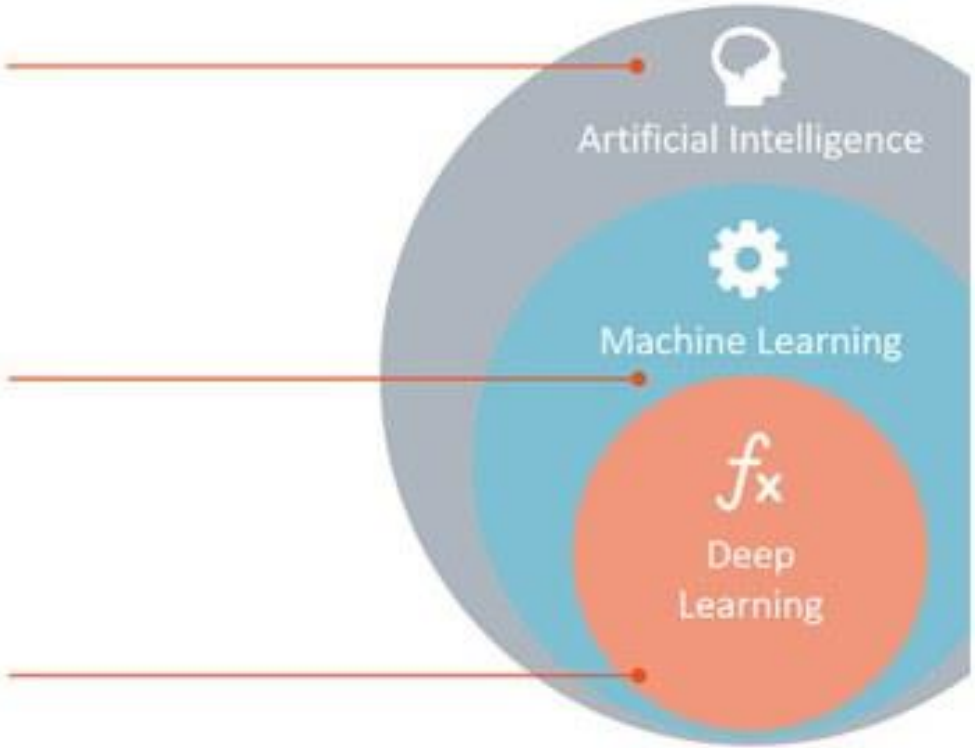
Any technique which enables computers to mimic human behavior.

Machine Learning

Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

Deep Learning

Subset of ML which make the computation of multi-layer neural networks feasible.



Picture Courtesy: Kdnuggests

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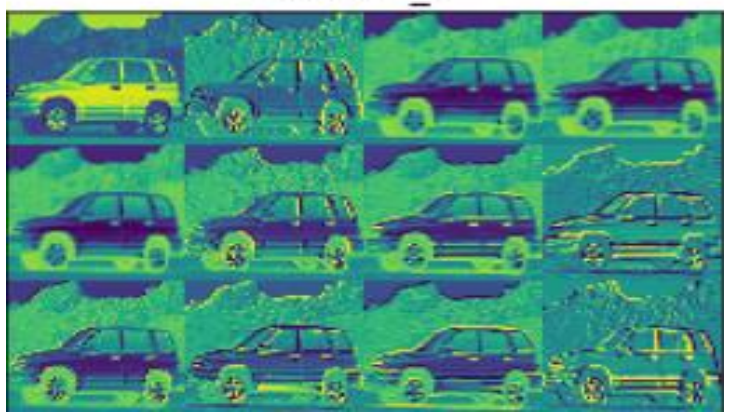
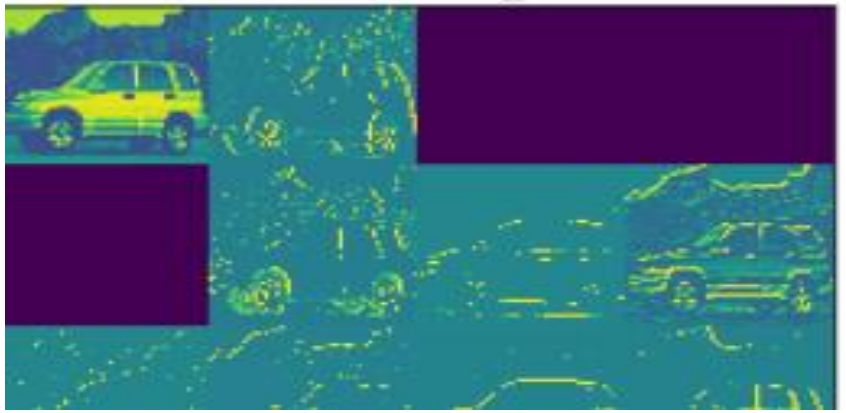
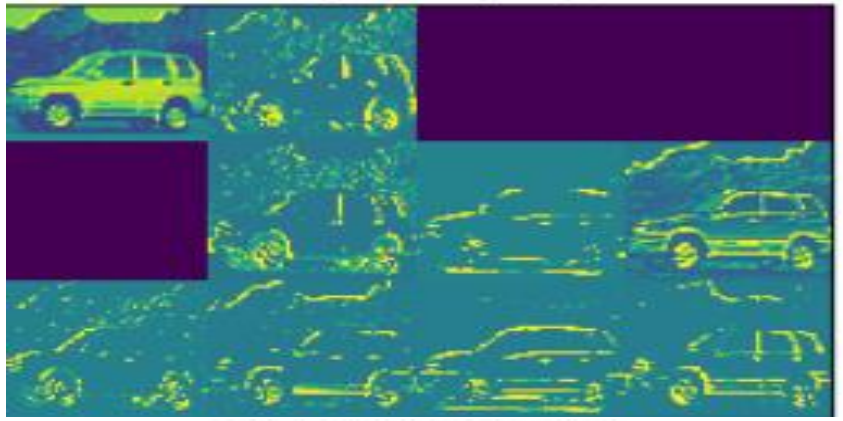
conv2d_5



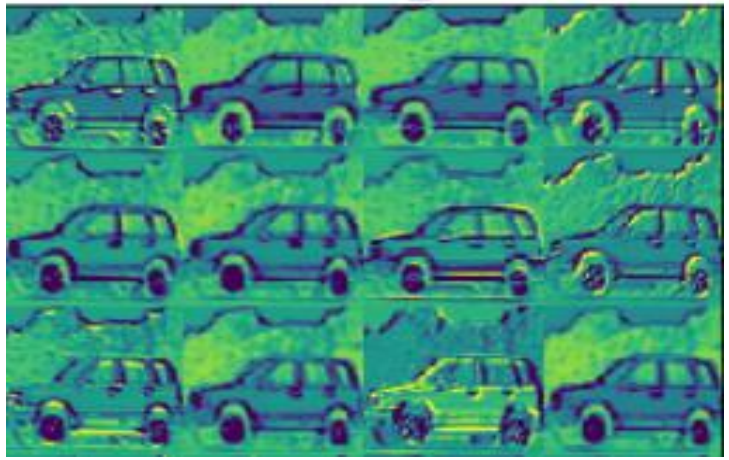
activation_7



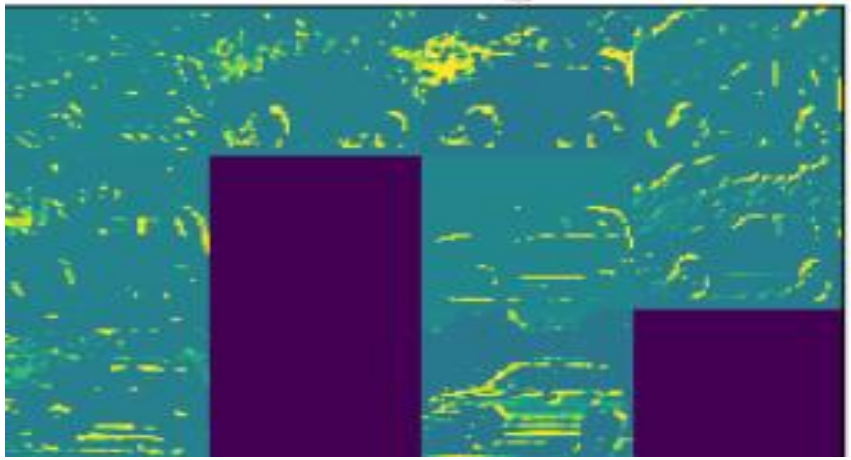
max_pooling2d_5



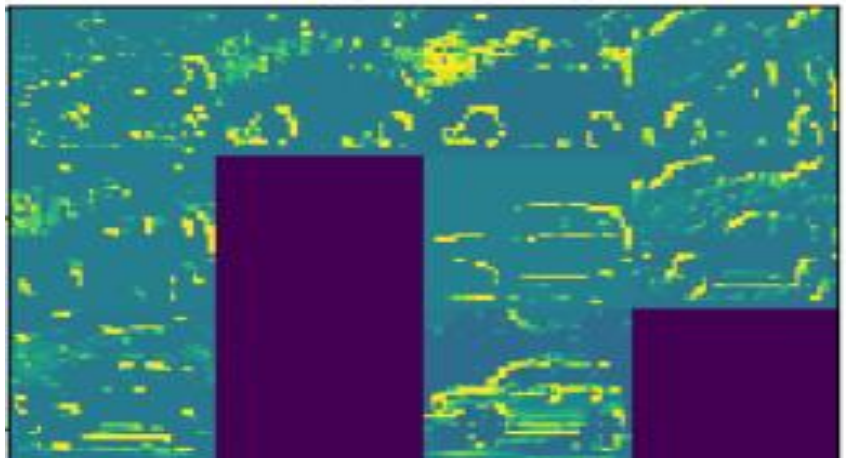
conv2d_6



activation_8



max_pooling2d_6



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Vehicle 91%

Pedestrian 90% ± 5% (except two with 47% & 68%)

Vehicle 90%

Pedestrian 30-85%

Vehicle 100%

Pedestrian 96%

Vehicle 96%

Pedestrian 98% ± 5%

Pedestrian 95% ± 15%

Vehicle 99%

Pedestrian 98%

Vehicle 99% (One False-Positive Vehicle 80%)

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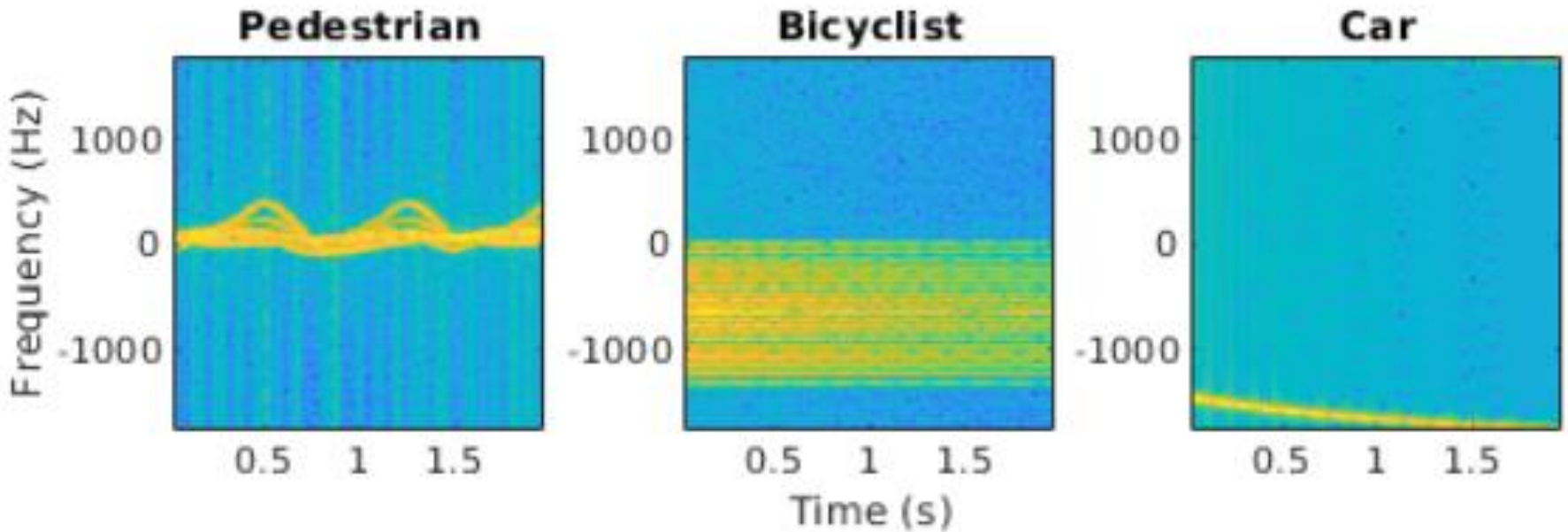

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Risk Assessment !!

APPLICATIONS:

- Passenger tracking
- Platform risk analysis (Crossline near train’s door)
- Categorising users (Passenger with bags or bicycles)
- Analyse for any Suspicious behaviour
- And more ….

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