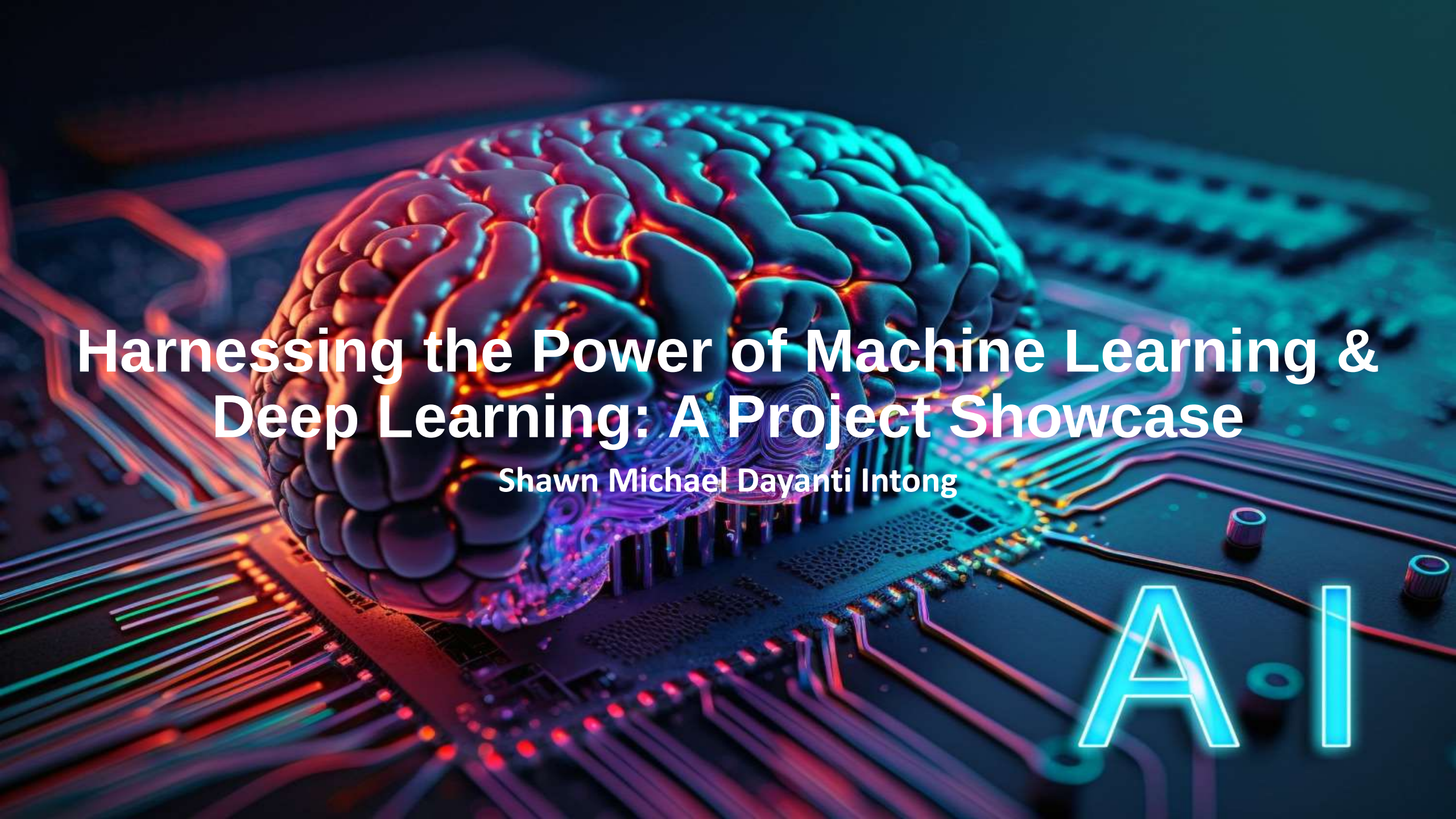


Harnessing the Power of Machine Learning & Deep Learning: A Project Showcase

Shawn Michael Dayanti Intong

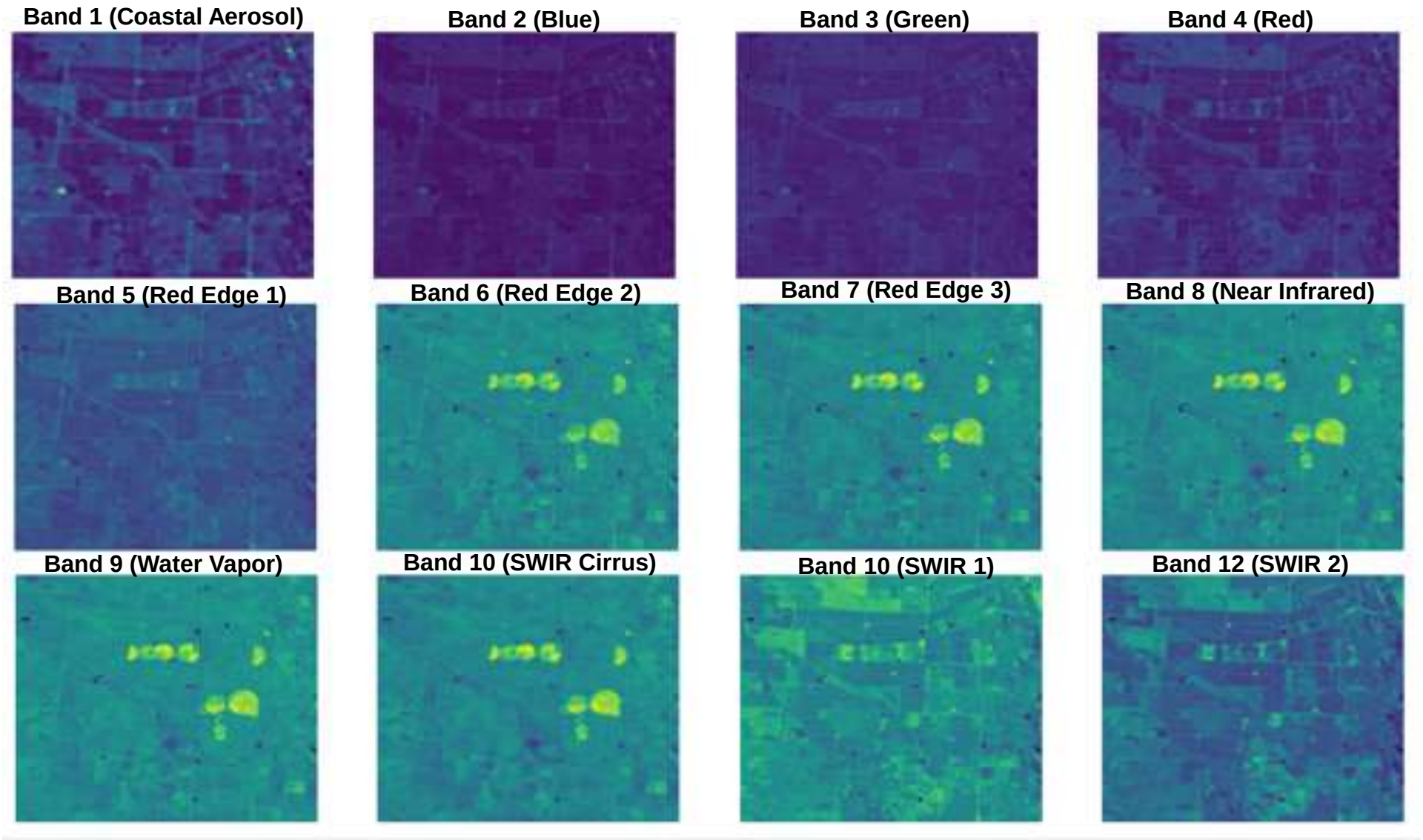
About Me

- I’m a final year undergraduate physics student at University of Indonesia.
- I have a big interest in machine learning and deep learning especially its application in computer vision.
- I’m currently a Machine Learning (ML) cohort at Bangkit 2024.
- Technical Skills: Python, Numpy, Pandas, Matplotlib, Seaborn, OpenCV, Scikit-learn, Tensorflow


Field Area Segmentation

Libraries Used

Sentinel-2 Satellite Images with 12 bands



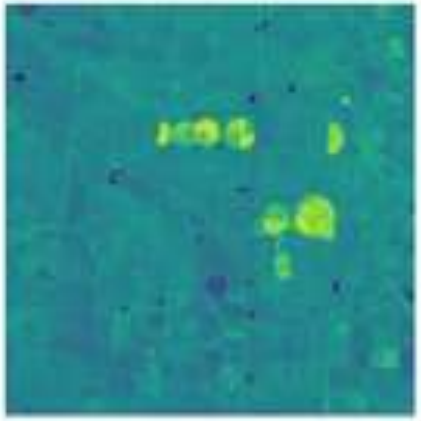
Use Only 10 m Resolution Bands

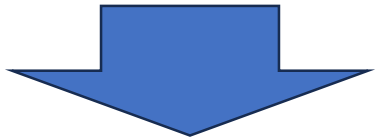
Band 2 (Blue)

Band 3 (Green)

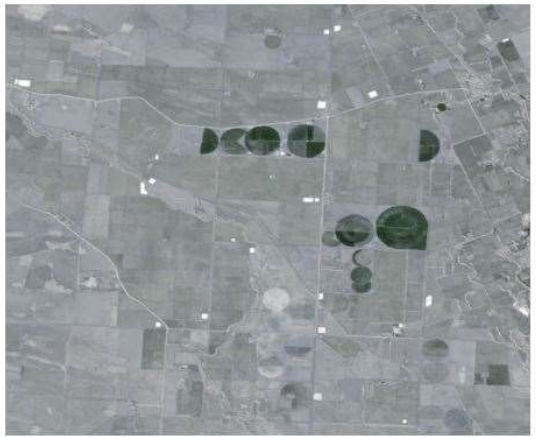
Band 4 (Red)

Band 8 (Near Infrared)





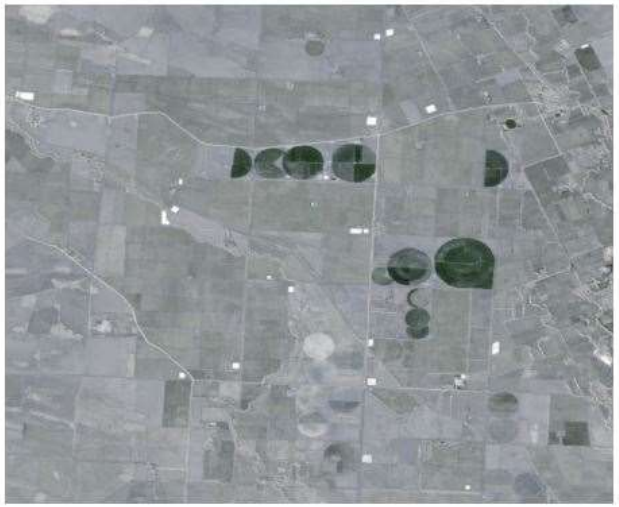
Composite Image



Binary and Edge Masks Generation

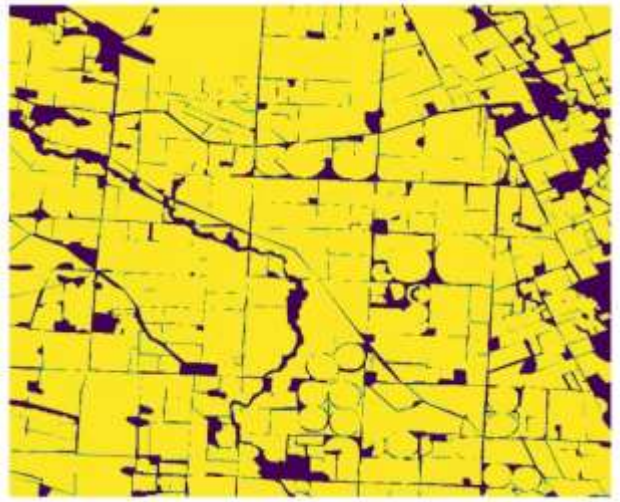
Extract (x, y) points of each Polygon of Image → Use OpenCV “fillPoly” to create **binary mask** → Use Sobel edge detection to create **edge mask**

Composite Image



Edge Mask

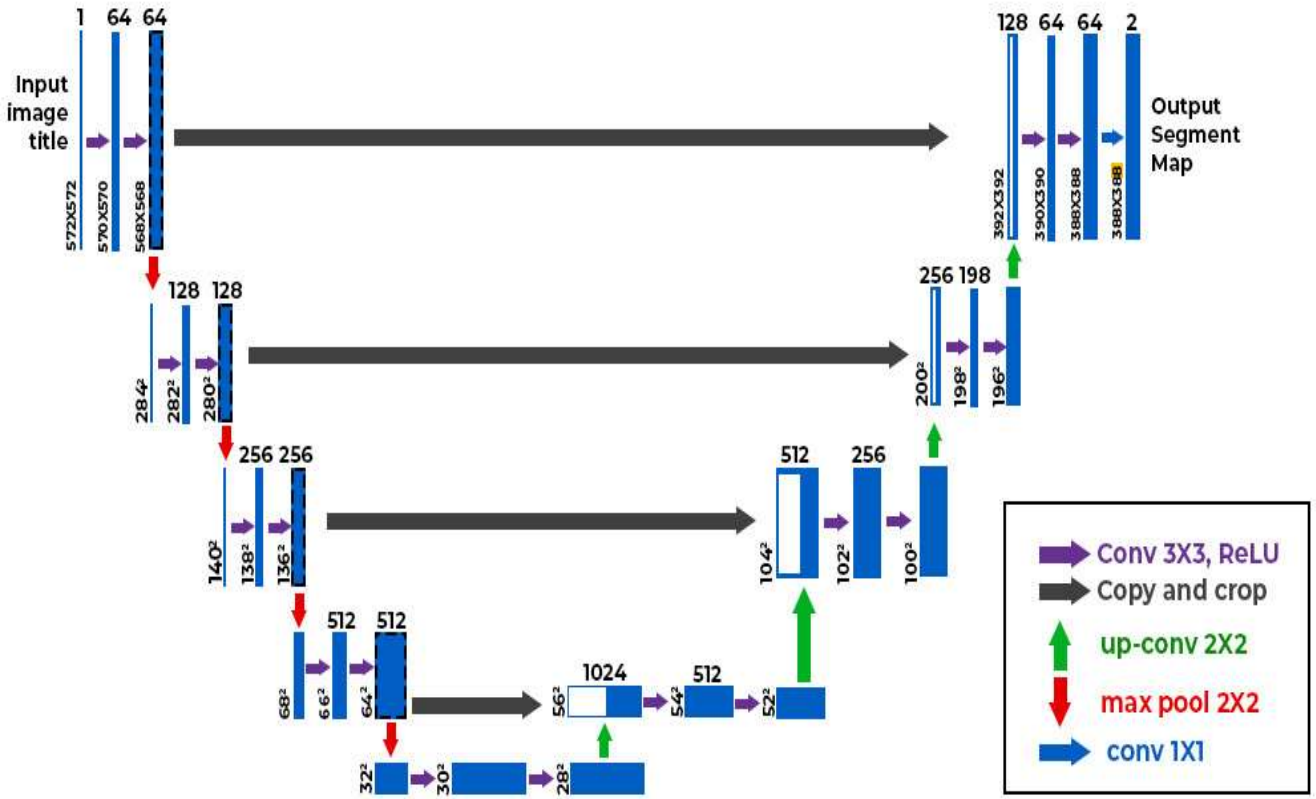
Binary Mask



Inputs

Output

Model Architecture

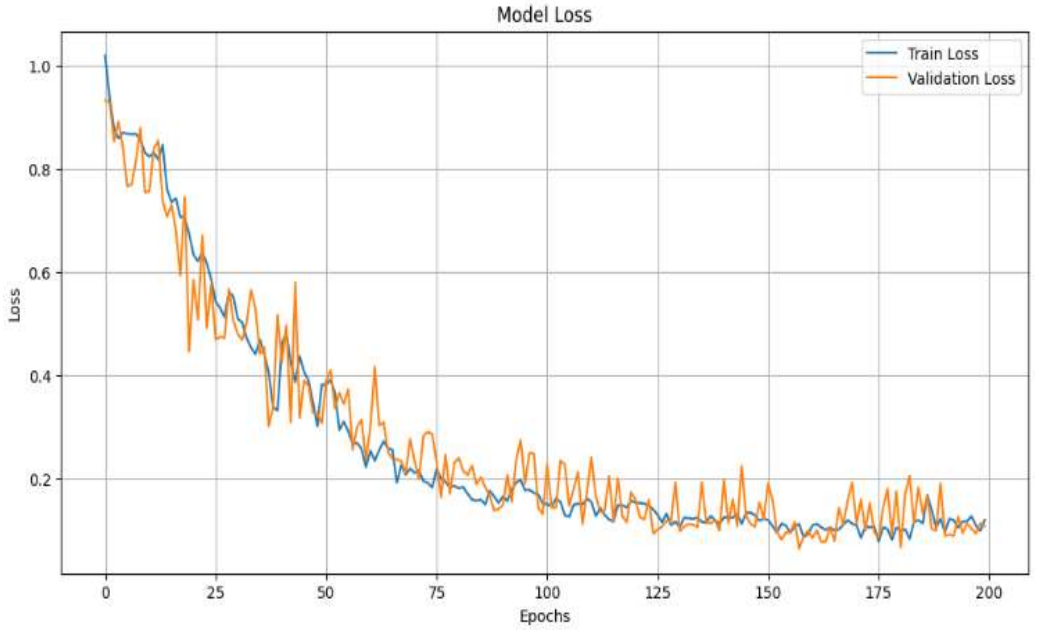


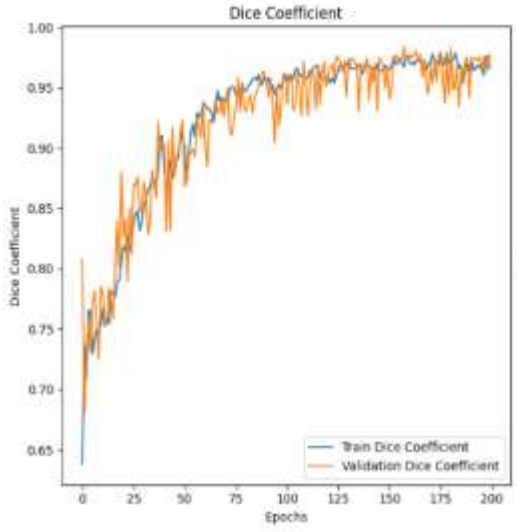
Model Training

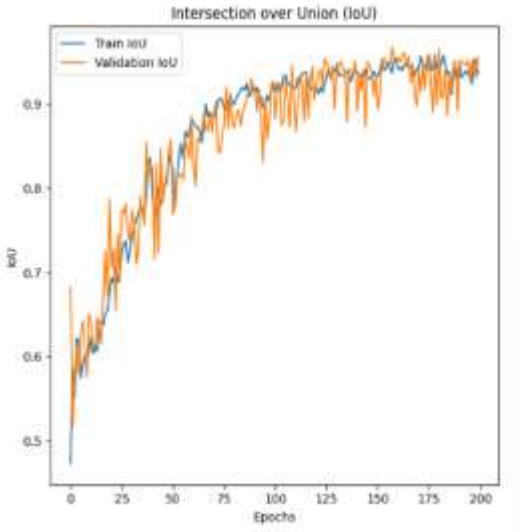
Hyperparameters	Value
Training Batch Size	8
Validation Batch Size	2
Image Input Shape	(1024, 1024, 4)
Optimizer	Adam
Learning Rate	0.001
Loss Functions	Binary Cross Entropy + Dice Loss
Evaluation Metrics	Dice Coefficient + IOU
Training Epochs	100

Model Evaluation

Link to Project: https://github.com/ShawnMikey/Field-Area-Segmentation







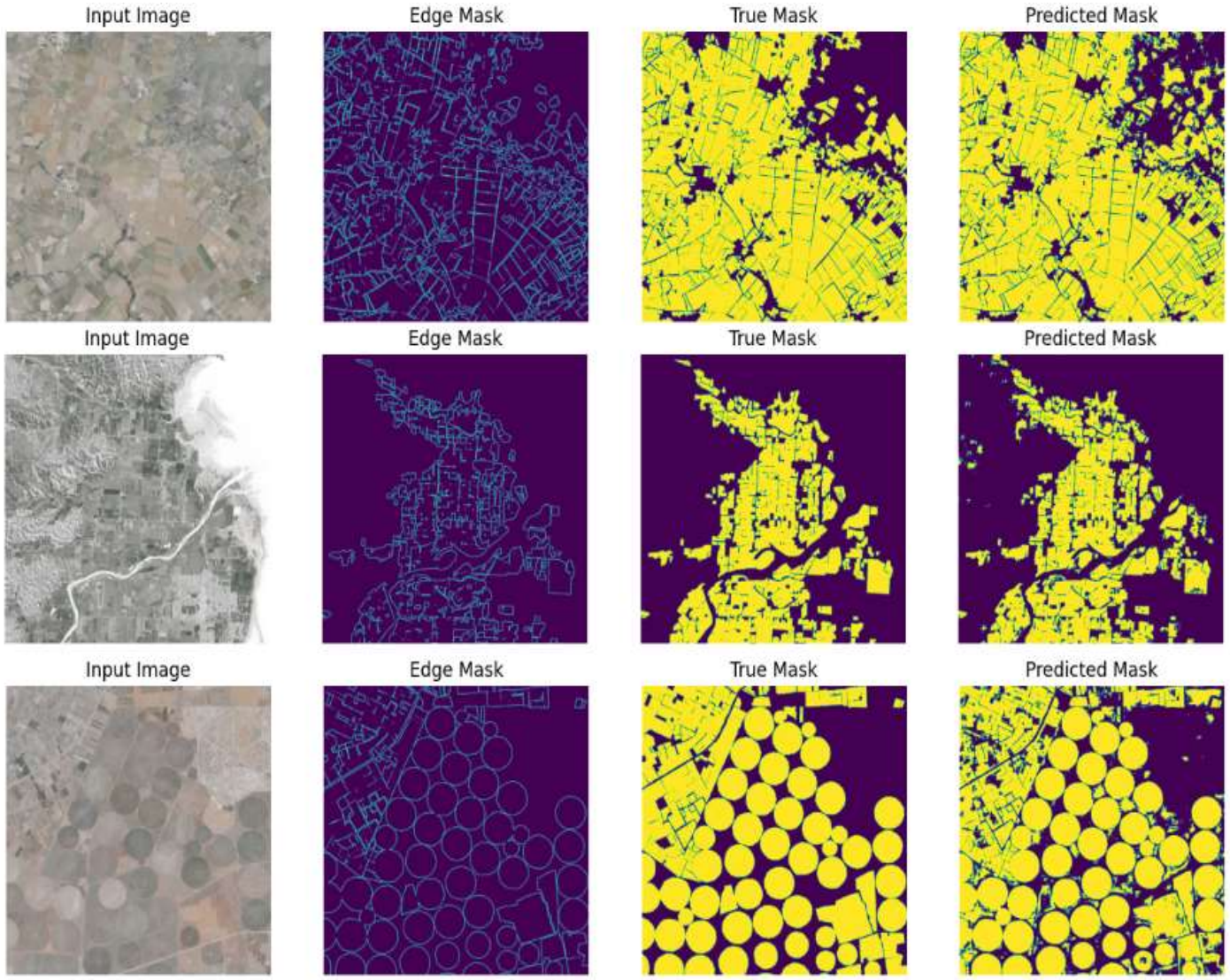


Image Based Air Quality Estimation

Libraries Used

RGB Images with Sky Background

Corresponding Air Quality Metrics

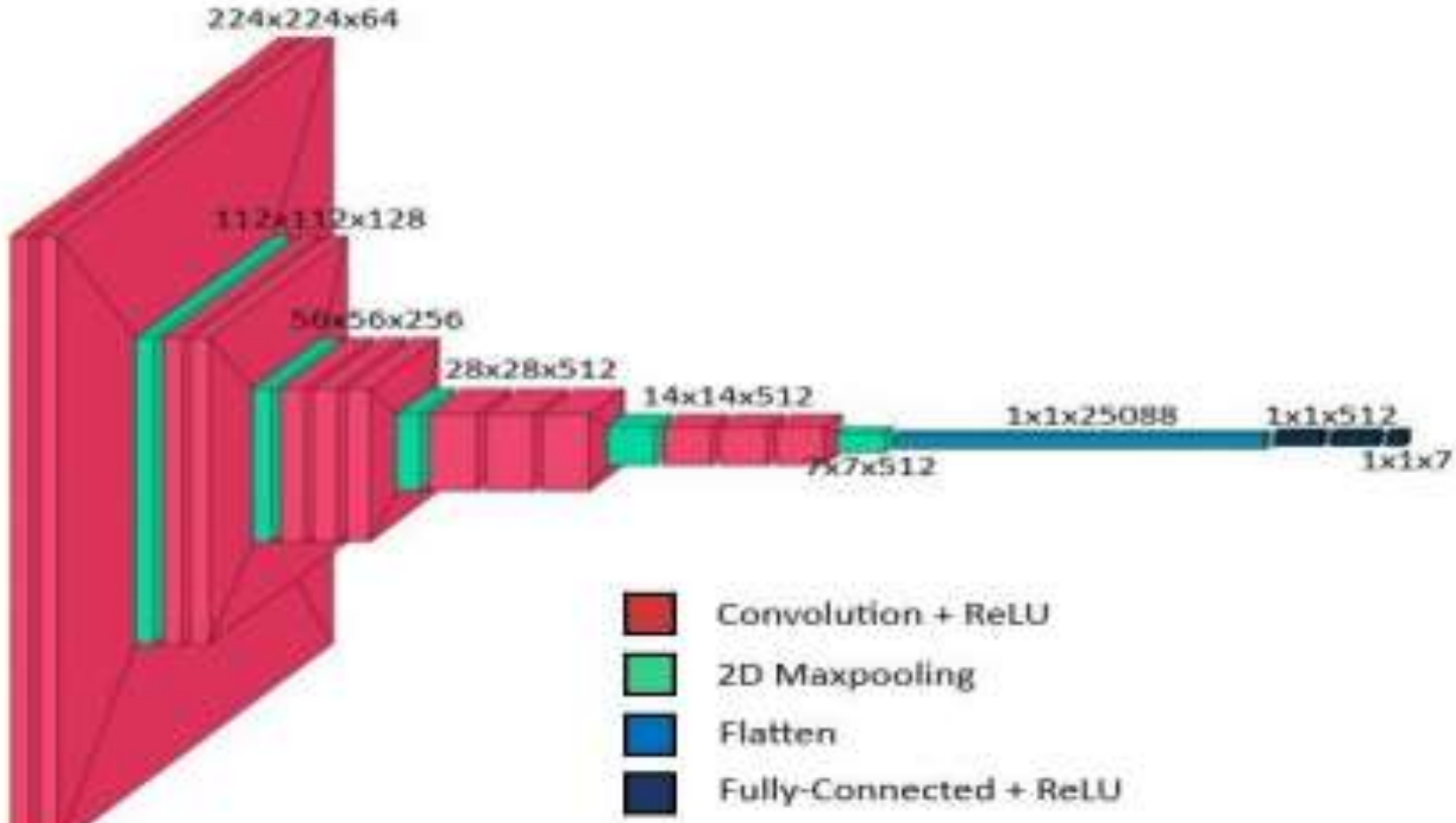
	Location	Filename	Year	Month	Day	Hour	AQI	PM2.5	PM10	O3	CO	SO2	NO2	AQI_Class
0	Biratnagar, Nepal	BRI_Un_2023-02-02-12.00-9.jpg	2023	2	2	12:00	158	70.08	100.82	58.89	0.49	4.4	1.04	d_Unhealthy
1	Biratnagar, Nepal	BRI_Un_2023-02-02-12.00-8.jpg	2023	2	2	12:00	158	70.08	100.82	58.89	0.49	4.4	1.04	d_Unhealthy
2	Biratnagar, Nepal	BRI_Un_2023-02-02-12.00-7.jpg	2023	2	2	12:00	158	70.08	100.82	58.89	0.49	4.4	1.04	d_Unhealthy
3	Biratnagar, Nepal	BRI_Un_2023-02-02-12.00-6.jpg	2023	2	2	12:00	158	70.08	100.82	58.89	0.49	4.4	1.04	d_Unhealthy
4	Biratnagar, Nepal	BRI_Un_2023-02-02-12.00-5.jpg	2023	2	2	12:00	158	70.08	100.82	58.89	0.49	4.4	1.04	d_Unhealthy

	Year	Month	Day	AQI	PM2.5	PM10	O3	CO	SO2	NO2
count	12240.000000	12240.000000	12240.000000	12240.000000	12240.000000	12240.000000	11938.000000	11660.000000	10757.000000	11800.000000
mean	2022.947631	2.686111	12.114706	167.626797	142.999267	145.663935	39.491436	101.230361	13.239595	37.843576
std	0.222780	1.774345	8.269053	102.818213	130.745815	104.506951	33.342031	115.910128	9.850507	39.551303
min	2022.000000	2.000000	1.000000	15.000000	4.000000	7.000000	1.000000	0.000000	2.000000	0.670000
25%	2023.000000	2.000000	3.000000	97.000000	35.000000	64.000000	13.000000	4.000000	4.400000	7.000000
50%	2023.000000	2.000000	13.000000	152.000000	70.080000	113.000000	31.000000	52.000000	10.000000	20.000000
75%	2023.000000	3.000000	20.000000	230.000000	257.000000	198.000000	59.660000	174.000000	20.000000	64.000000
max	2023.000000	10.000000	28.000000	450.000000	500.000000	480.000000	225.000000	410.000000	57.000000	169.000000

Modelling Schemes

Model	Features
VGG16	Images
VGG16 + Dense Layer	Images, Timeseries
VGG16 + Dense Layer	Images, Timeseries, HSV

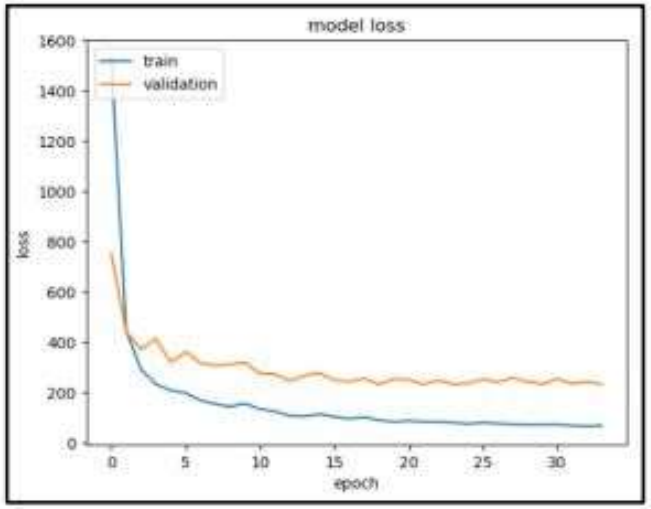
VGG16 Architecture



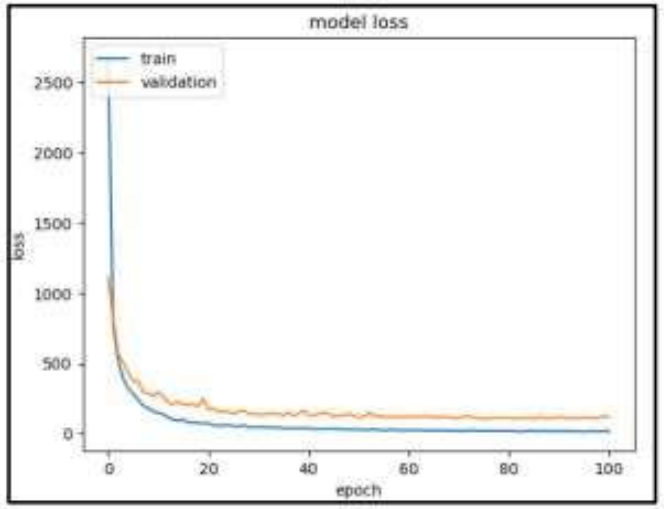
Model Training

Hyperparameters	Value
Training Batch Size	32
Validation Batch Size	8
Image Input Shape	(224, 224, 3)
Optimizer	Adam
Learning Rate	0.001
Loss Functions	Mean Squared Error
Evaluation Metrics	Root Mean Squared Error
Training Epochs	150

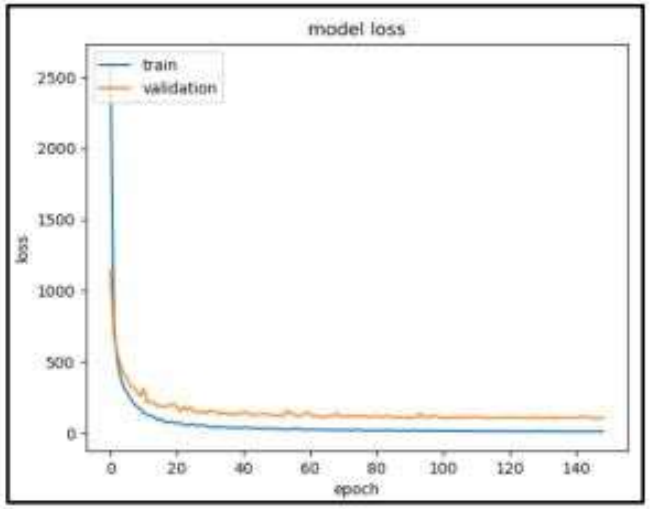
Model Evaluation



Kurva Loss untuk VGG16



Kurva Loss untuk VGG16 + Timeseries



Kurva Loss untuk VGG16 + Timeseries + HSV

Model	Features	RMSE
VGG16	Images	15,282184595653366
VGG16 + Dense Layer	Images, Timeseries	11,204401132426852
VGG16 + Dense Layer	Images, Timeseries, HSV	10,451656768734122

Link to Project: https://github.com/ShawnMikey/Image-Based-AirQuality-Estimation