Session 9: Emerging Technologies and Use Cases PART C

Speaker

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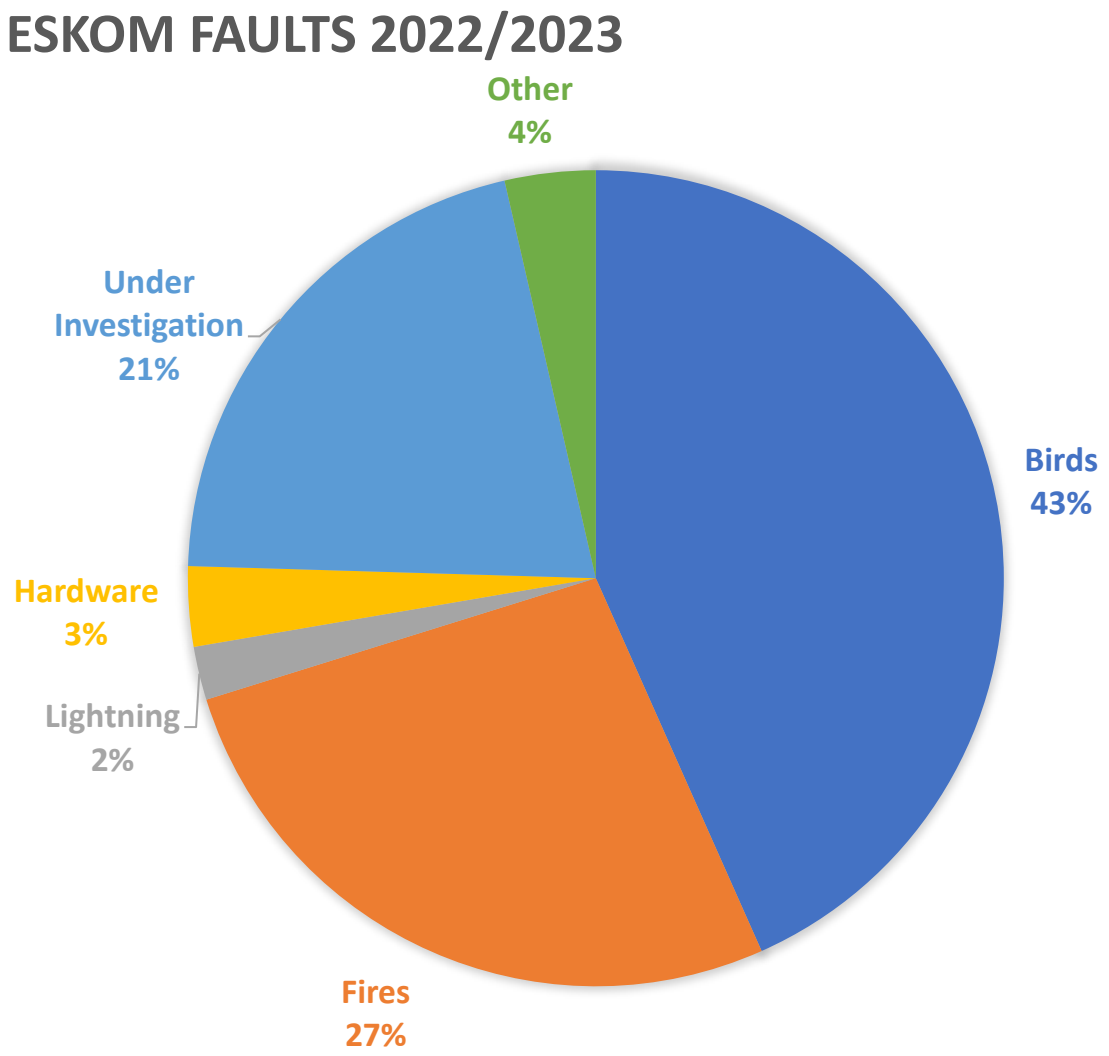
ESKOM

Major Disruptors to the Grid

- The Electric Power utility faces significant challenges in terms of environmental factors that are only exacerbated by factors such as Global warming.



Severe Weather and the Grid

Image: Eskom

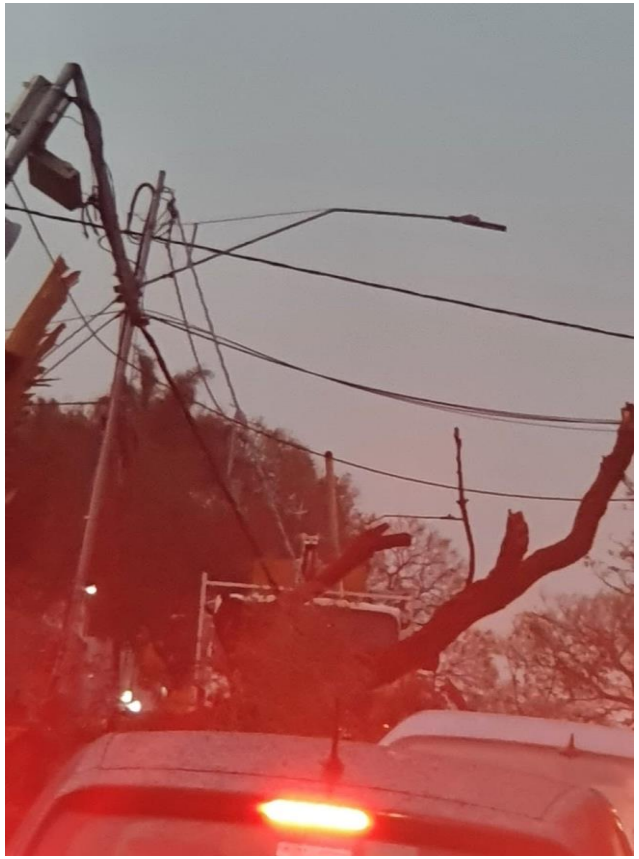


Image: Sunday Times

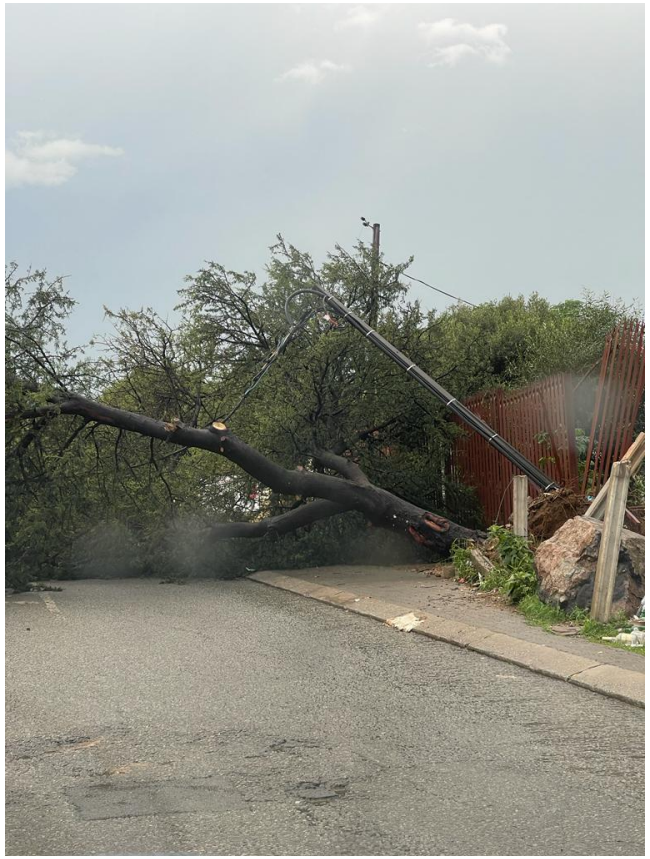
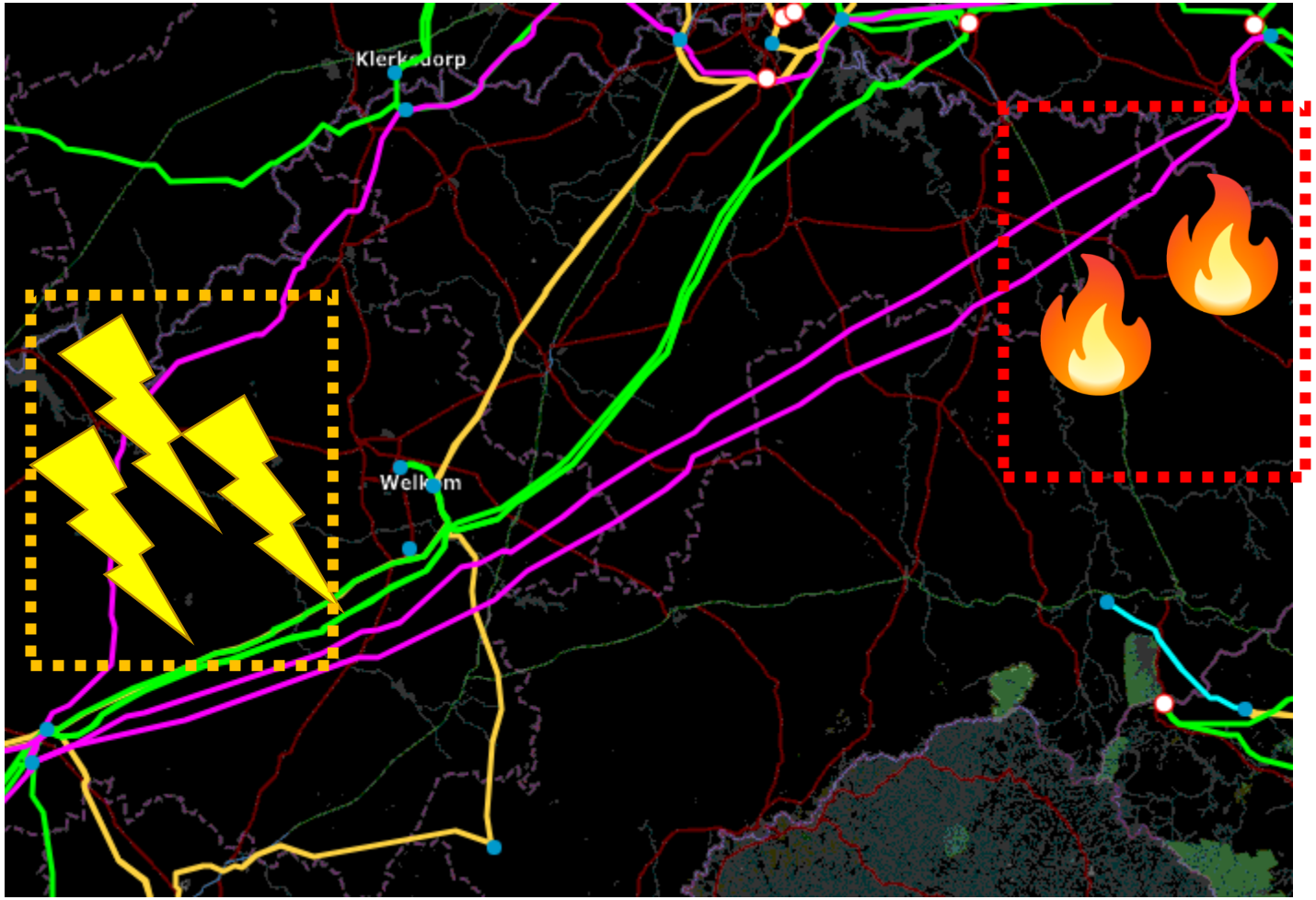


Image: Sunday Times

A.I. Created

- Eskom has endeavored to create Artificial intelligence to help mitigate these factors.

Background



Map: Openstreetmaps

- Alpha and Beta Substation
- Line Length ~436 Km
- Lightning and Fire could effect the across its entire distance.
- Use A.I. To Classify the threat and inform decision making.
- Pre-emptive warning on possible trip.

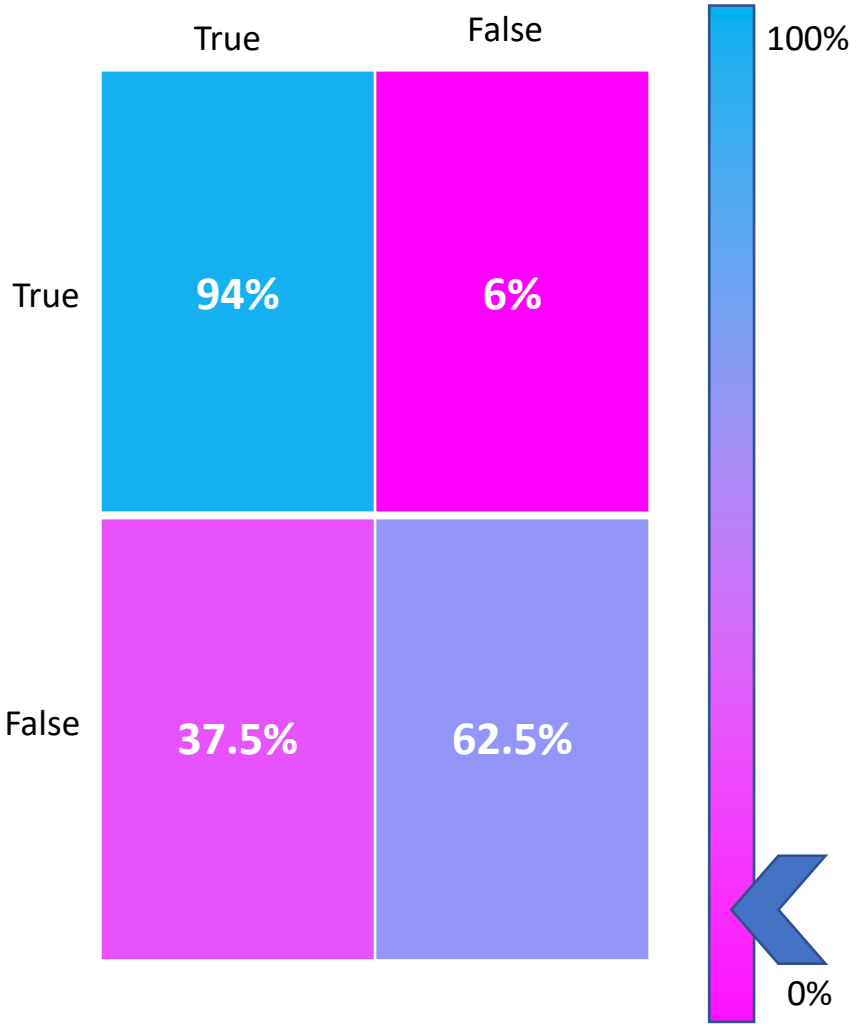
A.I. Created - Fire

Table 6: Correlation matrix fire model parameters

	frp	fspd	cnf	brght	temp	hum	windx	windy	fsx	fsy	blat	blon	dsbrnt
outage	0.21	-0.05	0.00	0.06	0.01	-0.10	-0.08	0.05	-0.01	0.03	0.06	0.02	-0.04
frp		0.09	0.29	0.27	0.03	-0.12	-0.15	0.11	-0.03	0.06	-0.04	-0.06	-0.15
fspd			0.09	0.14	0.12	-0.21	-0.04	0.09	-0.01	-0.01	0.03	0.02	0.06
cnf				0.31	0.14	-0.02	0.02	0.02	-0.02	0.02	-0.07	-0.02	-0.09
brght					0.36	-0.14	-0.03	0.10	0.00	-0.03	-0.08	-0.13	0.12
temp						-0.36	-0.04	0.20	-0.04	-0.07	-0.04	-0.07	0.05
hum							0.27	-0.14	-0.01	0.03	-0.25	0.00	-0.16
windx								-0.12	-0.02	-0.02	0.05	-0.02	-0.04
windy									0.02	-0.01	0.05	0.10	0.05
fsx										0.04	-0.02	-0.02	0.05
fsy											-0.01	0.00	-0.07
blat												0.62	-0.08
blon													-0.15

Methodology:

- Total data points trained: 2000+.
- Dataset: Listed previously
- Neural Network: FaNN
- Prediction: Is the fire going to cause an outage?
- Metric: Outage logs vs. Fire activity.



<u>Results:</u>

Precision:94.0%,

Selectivity:62.5%

Geometric Mean: 76.7%

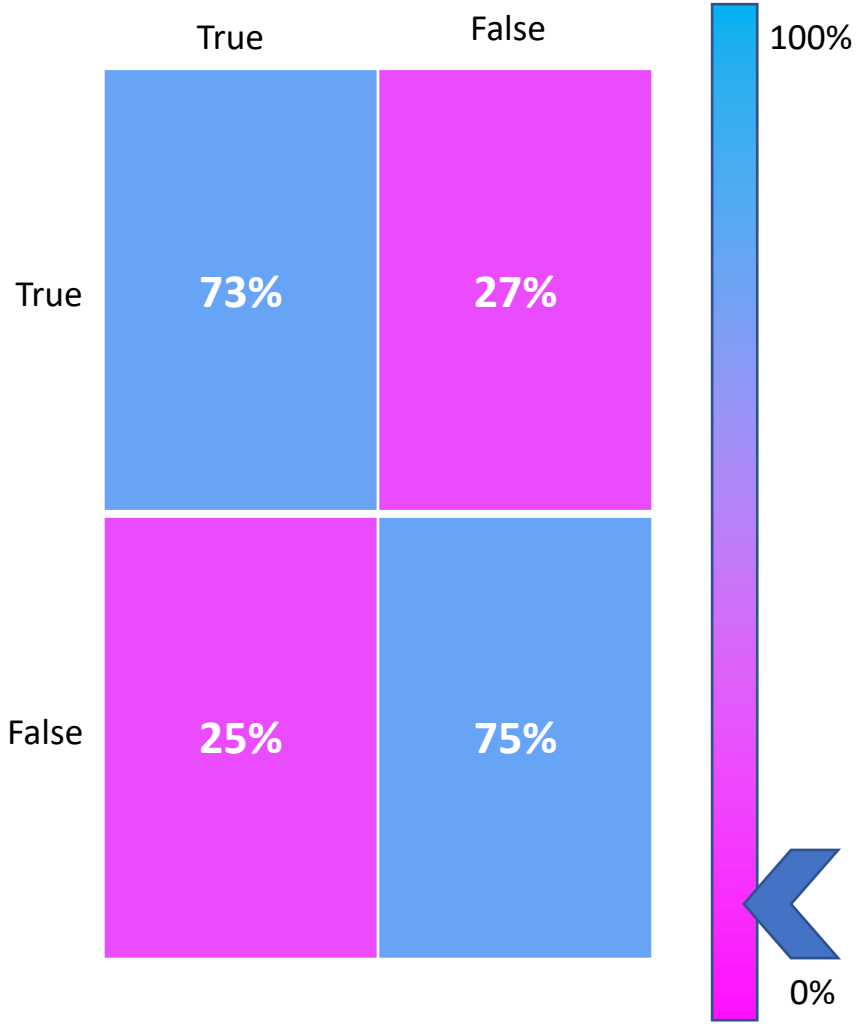
A.I. Created - Lightning

Methodology:

- Total data points trained: 1million +
- Dataset: Clusters and kA of Strikes
- Neural Network: Random Forest
- Prediction: Can the Storm cluster cause an outage?
- Metric: Outage logs

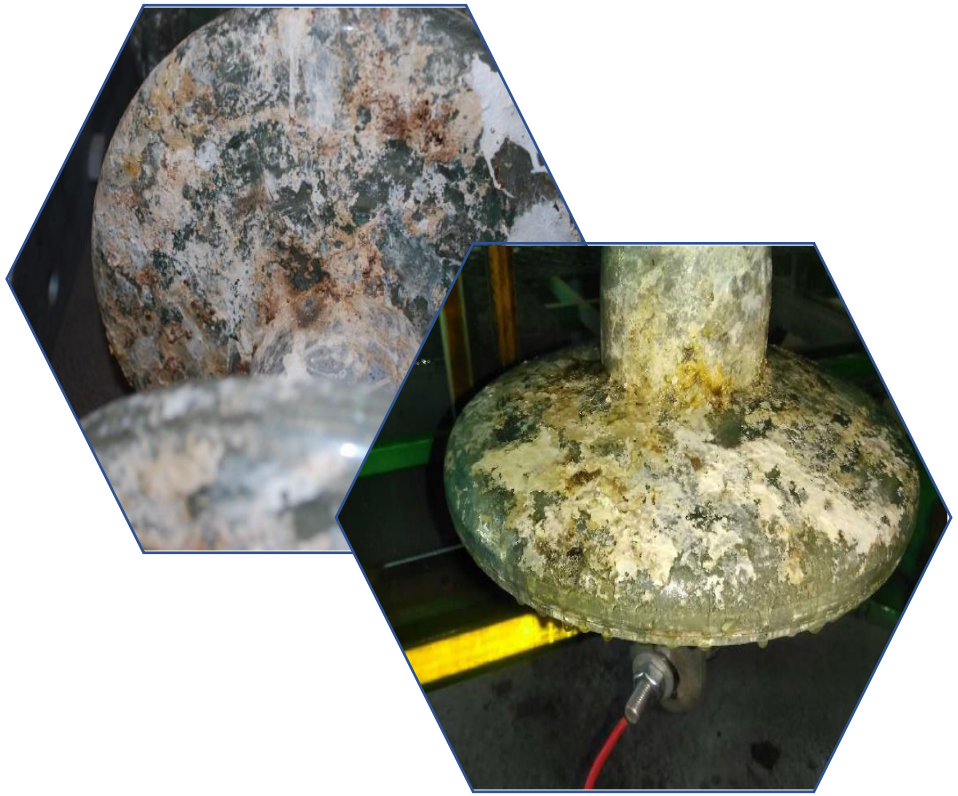
<u>Results:</u>
Precision:73.0%,
Selectivity:75%

Geometric Mean: 74%



A.I. Birds

Insulator
Pollution



Streamer
Flash-overs

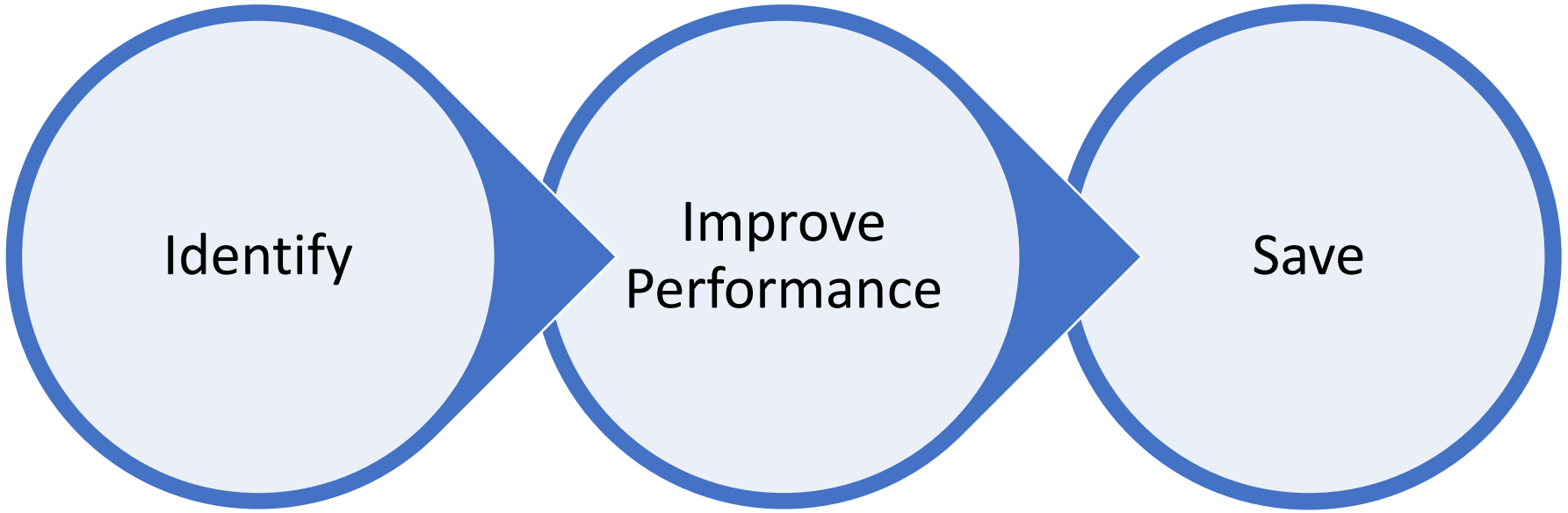
Fatalities

A.I. Birds

- Large dataset.
- Human Error.
- Tracking effectiveness becomes difficult.
- Large amount of man hours necessary.
- > 36000km to monitor (132kV to 765kV alone).

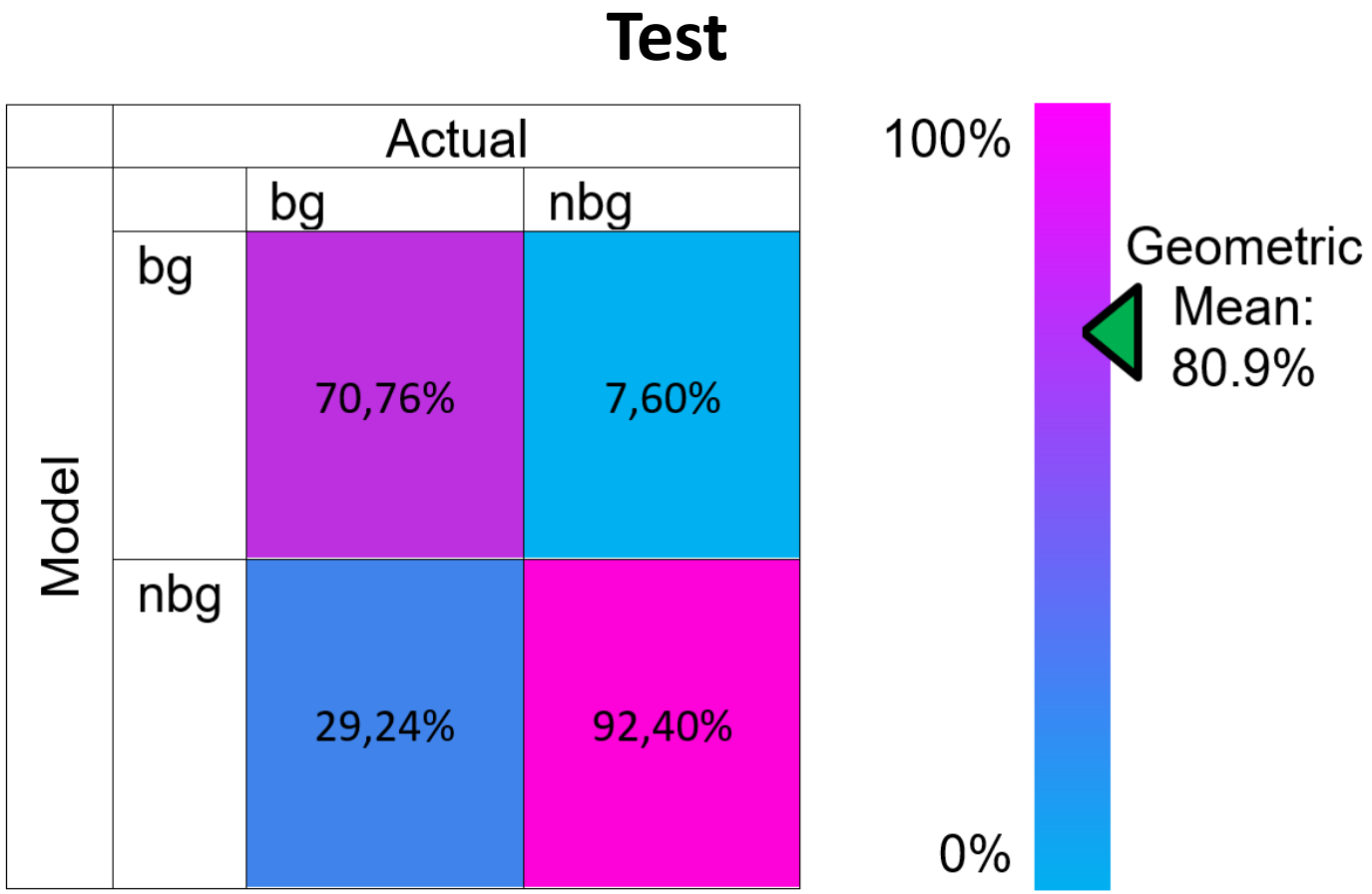
A.I. Birds

- Identify Bird Guards without Human Intervention (A.I.).
- Save on man hours.
- Improve overall data set used for bird mitigation measures.

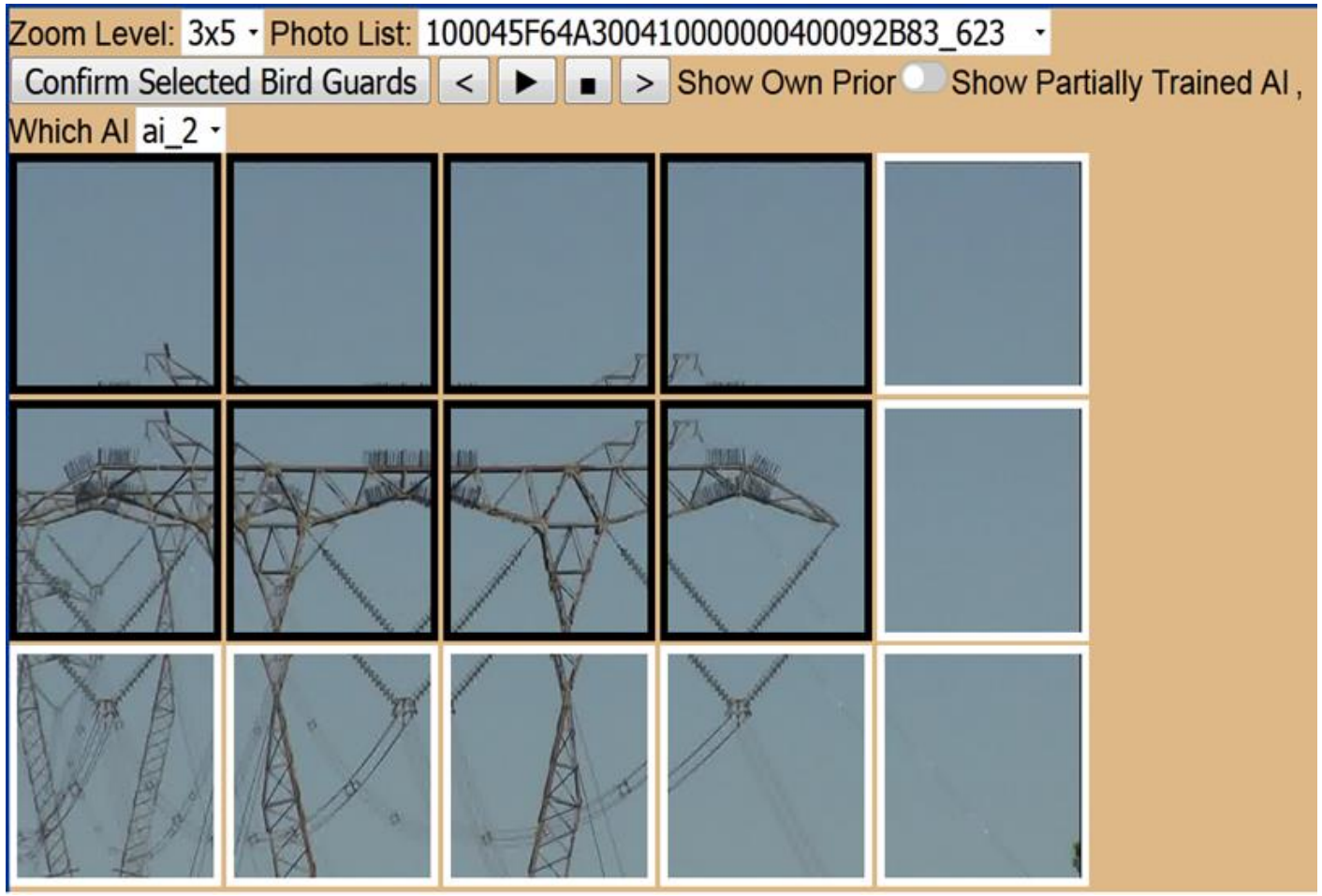


A.I. Birds

- Added imagery (2619 images, 175497 partials):



A.I. Birds


Zoom Level: 3x5
Photo List: 100045F64A30041000000400092B83_623
Confirm Selected Bird Guards
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▶
■
>
Show Own Prior
Show Partially Trained AI ,
Which AI ai_2

A.I. Birds

- Results from training and testing suggest that using a Deep Belief Network (DBN) and the FANN library yields usable results in classifying imagery supplied to a trained model.
- The more images the DBN was exposed to the better it became at identifying bird guards within the testing set rising from an initial 69.5% to a substantial 80% across the geometric mean (increase from 209 images to 2619 images in training data).

- It was found that the AI typically overestimates the number of partial images containing bird guards with approximately 6%

- Current restrictions:
  - Protracted training period.
  - Limited dataset.

- Recommended use of Convolutional Neural Nets (CNN's) impractical for this investigation but are the preferred technology to be used given enough data as an input.

Thank you

Any questions?

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