

FlgLib & SmokeyNet: Dataset and Deep Learning Model for Real-Time Wildland Fire Smoke Detection

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Motivation

Quick Progression of 2016 Southern California Wildfire:



Fire Start

+5 mins

+10 mins

+20 mins

+40 mins



Problem Statement & Goals

Problem Statement



Smoke

?

No Smoke

Goals

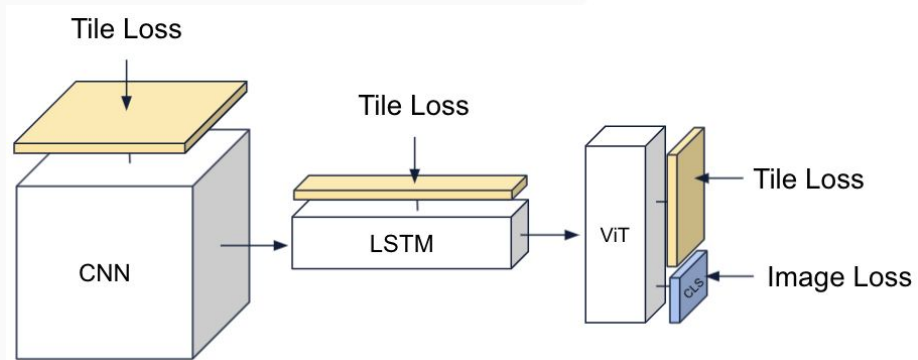
1. Quick Time-to-Detection
2. High Recall
3. High Precision
4. Real-time Performance

Main Contributions

Contribution #1: FlgLib



Contribution #2: SmokeyNet

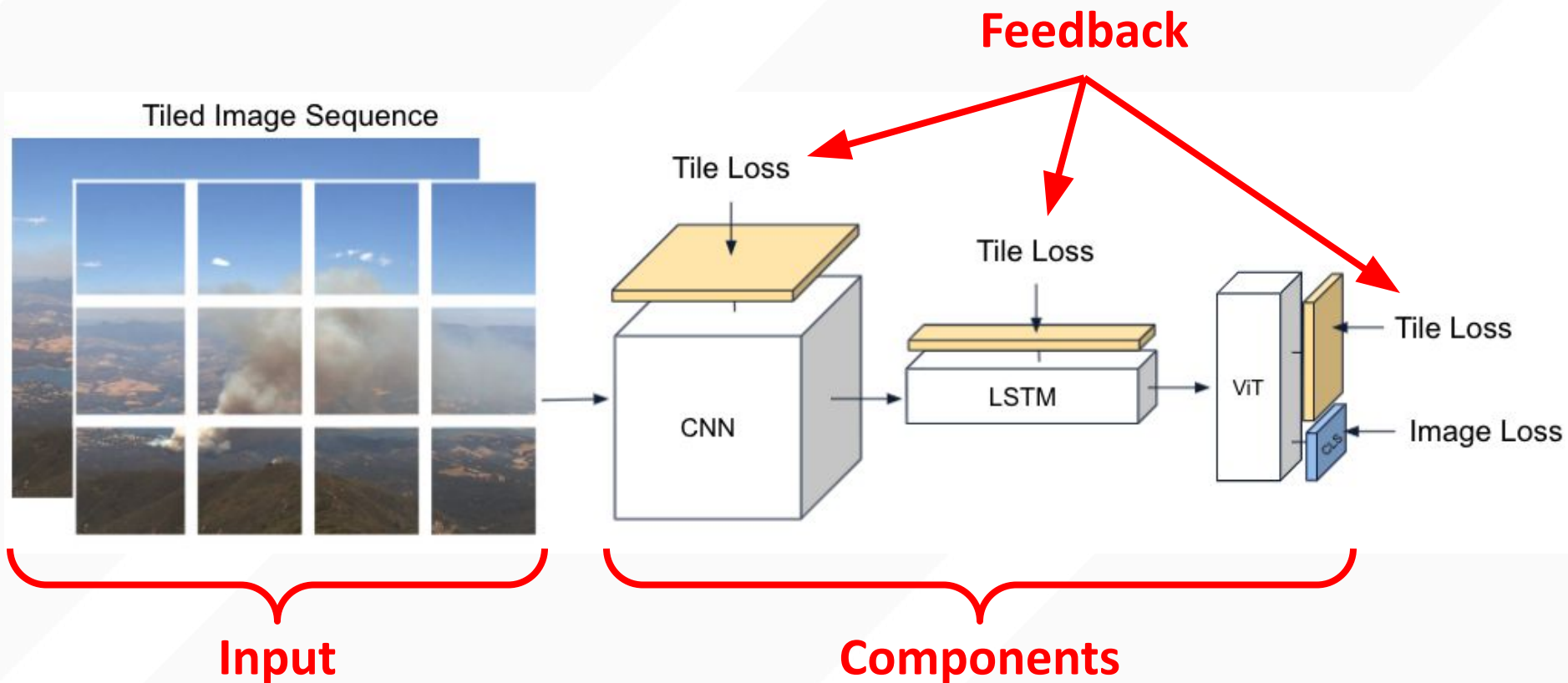


FlgLib Dataset



<https://drive.google.com/file/d/12DkEOWQfSw65zoGNQ1ISz9DKC-4SB85V/view?usp=sharing>

SmokeyNet Architecture



Results

Model	Params (M)	Time (ms/it)	A	F1	P	R	TTD (mins)
ResNet34 + LSTM + ViT	56.9	51.6	83.49	82.59	89.84	76.45	3.12
ResNet50 (1 frame)	26.1	50.4	68.51	74.30	63.35	89.89	1.01
FasterRCNN (1 frame)	41.3	55.6	71.56	66.92	81.34	56.88	5.01
MaskRCNN (1 frame)	43.9	56.9	73.24	69.94	81.08	61.51	4.18
ResNet34 + ResNet18-3D	38.0	57.5	83.10	82.26	88.91	76.65	2.87

Table 1. Accuracy (A), F1, precision (P), recall (R) and average time-to-detection (TTD) evaluation metrics on the test set, with 2 frames of input (unless otherwise stated) averaged over 5 runs. Number of parameters (in millions) and inference time (ms/image) should be minimized for deployment to edge devices.

Conclusion & Future Work

Future Work

1. Systematic Misclassifications
2. Model Distillation
3. Model Explainability
4. Deployment to Edge Devices

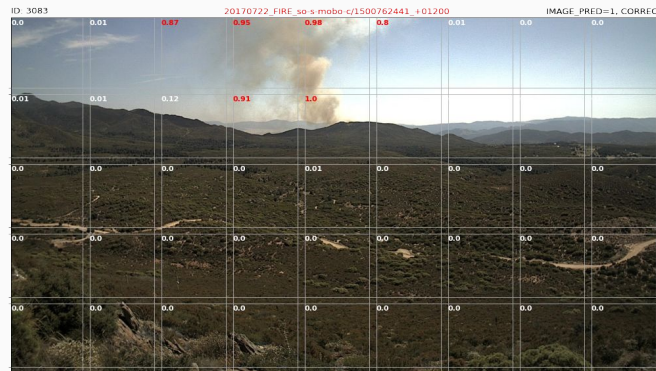


Figure 1. Correct classification of smoke.

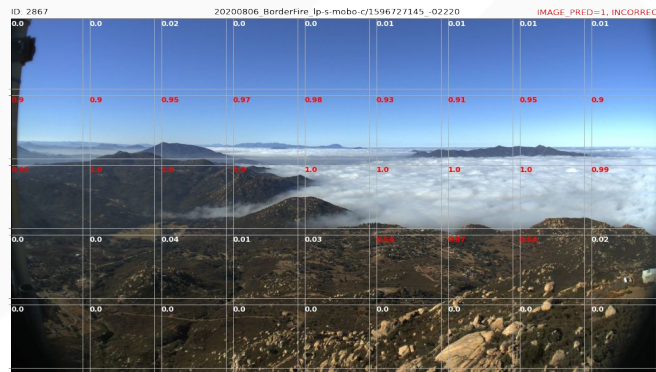


Figure 2. Misclassification of low altitude clouds.

Co-authors & Acknowledgements



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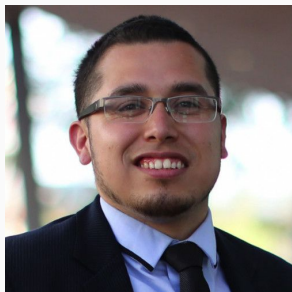


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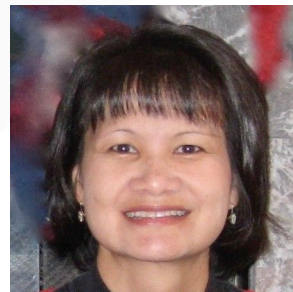
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