Image Based Forest Fire Detection Using CNN

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Introduction

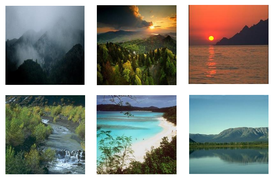
Forest fires are one of the most frequent and destructive threats to forests, causing severe damage to the ecology and local ecosystems. To protect forests from such devastation, early detection and preventive measures are essential. Traditionally, two main approaches have been employed for early detection through human surveillance: direct human observation and remote video monitoring.

In this poster, a cutting-edge forest fire detection approach using convolutional neural networks (CNNs) is presented to automatically identify fire in images. This advanced method not only reduces false alarms but also delivers superior accuracy compared to conventional techniques, offering a more reliable and efficient solution for early fire detection.

Dataset

Training Dataset

Dataset : Forest Fire Dataset[8]
fire images: 760
no-fire images: 760



Example images of no-fire images

Testing Datasets

1) Dataset 1

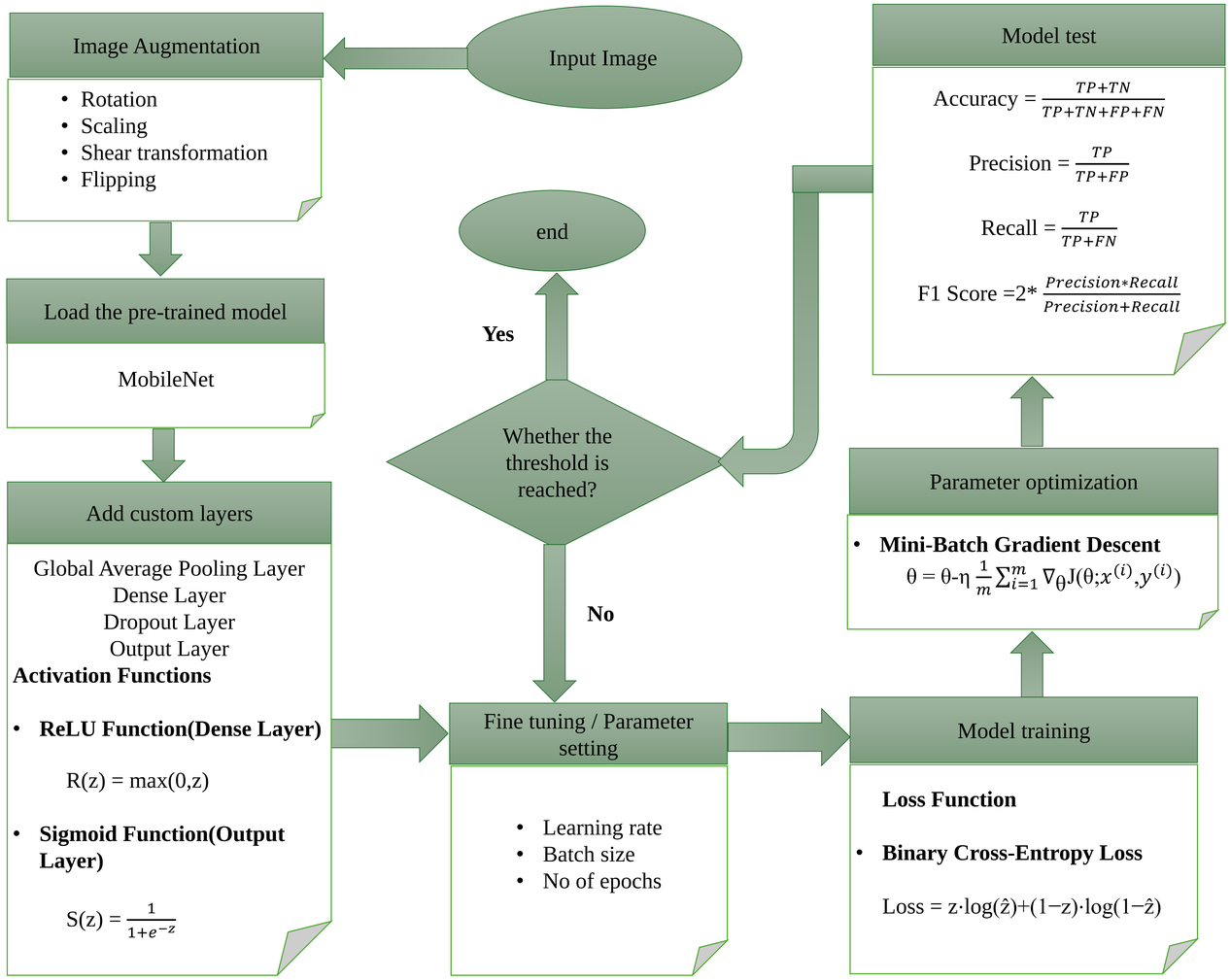
Name: Forest Fire Dataset[8]
fire images: 190
no-fire images: 190

2) Dataset 2

Name: Forest Fire Dataset[9]
fire images: 844
no-fire images: 844

Example images of the fire images

Methodology



Testing Results

In this poster, the state-of-the-art methods for forest fire classification on their respective local datasets are compared with our proposed approach, which has been specifically designed and evaluated on a dedicated forest fire detection dataset.

The same dataset as Khan et al. [1] is utilized here for testing(Dataset 1) and our proposed approach outperforms theirs across all key performance metrics. Specifically, our method shows superior results in terms of Accuracy, Recall, Precision, and F1 Score, highlighting its effectiveness in forest fire detection compared to other existing methods.

Methods	Accuracy	Precision	Recall	F1 Score
Khan et al. [1]	98.42%	97.42%	99.47%	98.43%
Sousa et al. [2]	93.6%	94.1%	93.1%	-
Govil et al. [3]	91%	-	-	89%
Tang et al. [4]	92%	-	-	-
Park et al. [5]	-	99.1%	97.8%	98.5%
Sun et al. [6]	94.1%	-	-	-
Khan et al. [7]	95.0%	95.7%	94.2%	94.96%
Ours(Dataset 1)	**99.21%**	**98.94%**	**99.47%**	**99.18%**
Ours(Dataset 2)	**96.80%**	**97.28%**	**96.27%**	**96.77%**

Performance comparison with other state-of-art methods

Conclusion

- This poster proposes a simple and efficient deep learning-based approach for the classification of forest fire images. Through extensive evaluation on the forest fire dataset, our method demonstrated superior performance compared to existing techniques.
- The proposed model consistently outperformed others across key metrics, including Accuracy, Recall, Precision, and F1 Score. These results highlight the effectiveness and reliability of our approach in accurately detecting forest fires, which can significantly contribute to timely disaster management and mitigation efforts. This approach also emphasizes the potential of deep learning in addressing critical environmental challenges such as forest fire detection.

References

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