Deep Learning model for wildfire detection through the fusion of visible and infrared information

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Motivation

- **Wildfires** can get out of control and have a significant **impact on the environment, properties, and lives**.
- **Early wildfire detection** is one of the most relevant aspects to be considered **to avoid as much damage as possible.**

Goal

- Perform **forest fire detection** in controlled datasets through a **Deep Learning** (DL) model through the usage of **fused visible-infrared information.**
- Obtain a **lower** false-positive rate when compared to **existing techniques**.

Solution model

- **Proposed solution model:**

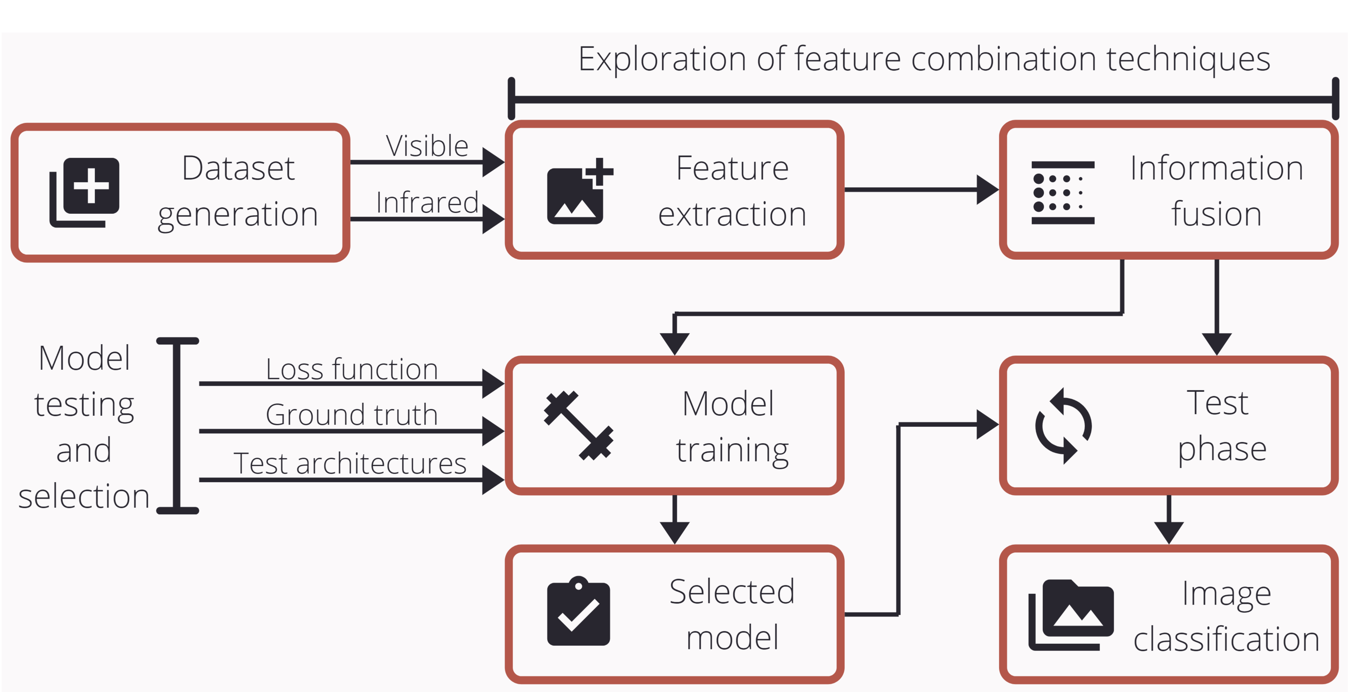


Fig. 1: Proposed solution model.

- We are in the process of **implementing, testing** and **adapting** selected **information fusion** techniques for the task of **fire image fusion**.

Methods

- **Pipeline of the proposed system:**

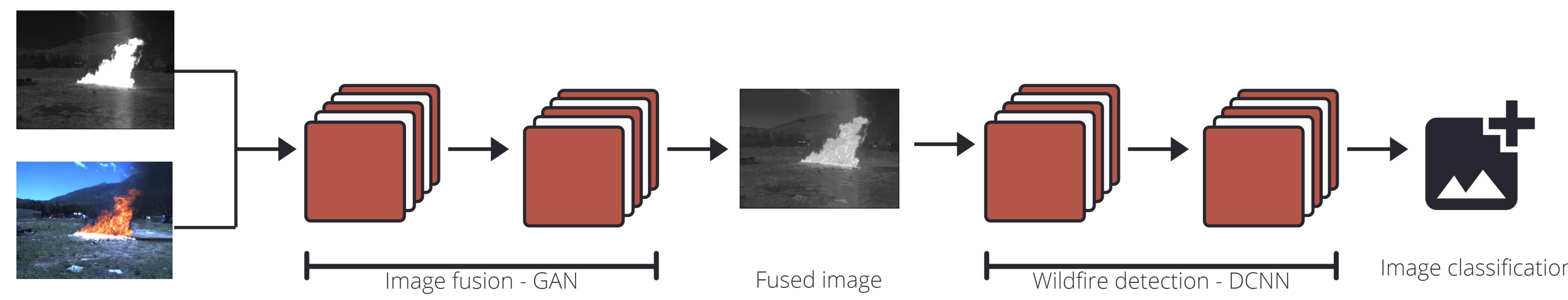
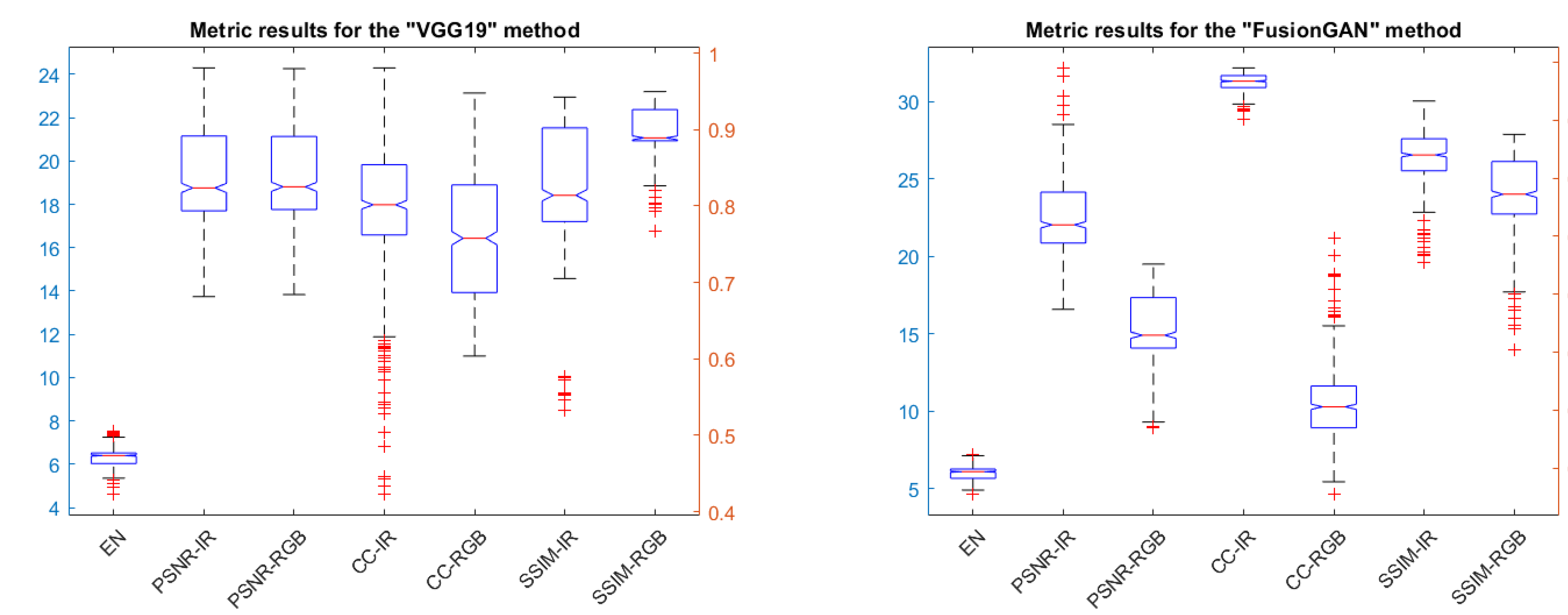


Fig. 2: Pipeline of the proposed system.

- We **evaluate** the performance of **selected image fusion methods** [1, 2] on the **test set** comprised of **640 visible-infrared image pairs** of the Corsican Fire Database [3] through the following **metrics**: image entropy (EN), correlation coefficient (CC), peak signal-to-noise ratio (PSNR) and structural similarity index measure (SSIM).

Results

- We present the results for the evaluated methods on Fig. 3.



(a) Results for the *VGG19* [1] method. (b) Results for the *FusionGAN* [2] method.

Fig. 3: Performance results for the analyzed image fusion methods.

- In Table I we present the average result comparison for the *VGG19* [1] and *FusionGAN* [2] methods.

Metric	VGG19	FusionGAN
EN	6.341551	6.007289
CC-IR-fused	0.797674	0.965768
CC-RGB-fused	0.763721	0.410448
PSNR-IR-fused	19.201477	22.509020
PSNR-RGB-fused	19.225560	15.390010
SSIM-IR-fused	0.833715	0.838937
SSIM-RGB-fused	0.900734	0.778314

Table I: Average results for the analyzed image fusion methods.

Discussion and future work

- **Both tested models performed well across the evaluated metrics**, with the **exception** of the **PSNR score.**
- **All tested models** implement DL architectures **pre-trained** on **different datasets**; the present work serves also as an **evaluation** of **how well** these methods **can generalize to different domains**.
- We **will implement** as well the **method proposed in [4]** and **compare** it with the two presented methods. **The best performing** of the three methods [1, 2, 4] will be selected for a **transfer learning phase**.
- With the **selected model**, we will **create** an **augmented fused fire image dataset**
- We will **use** said **dataset** to **train** the to-be-implemented **DL model** for **fire detection**, taking as a **launching pad** the **architecture proposed in [5].**

References

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Acknowledgments

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