



Deep Learning Smoke and Fire (DLSF) Technical Note

Technical Note

Introduction	3
Applications	3
Limitations	3
General Guidelines	4
Camera Position and Angle	4
Obstructions	4
Image and Stream Settings	4
Detection Range	5
Frequently Asked Questions	5
Does the DLSF Tracker learn while in use?	5
What image settings should I use?	5
Will it detect steam or fog?	5
Setup	6
General	6

Technical Note

Introduction

This technical note details the best practices for using the DL Smoke and Fire (DLSF) Tracker, along with guidelines on deployment conditions and configuration to ensure optimal performance.

Applications

The DLSF Tracker is a deep-learning-based model designed to detect the presence of smoke and flames within a camera video stream.

- **Early Warning:** Identifying potential fire hazards in industrial, commercial, or residential settings.
- **Monitoring:** Continuous surveillance of high-risk ignition areas where rapid response is critical.



Limitations

Performance may be suboptimal in the following scenarios:

- **Low Contrast:** Cases where smoke or flame does not contrast well against the background or surroundings.
- **Low Quality Video:** Instances where the bitrate is too low, or compression is too aggressive, resulting in heavy artifacts.
- **Stability Issues:** Use of unfixed or unstable cameras.
- **Scale:** Scenarios where the target area is too distant, or the smoke/fire appears too small within the frame.
- **Configuration:** Lack of defined exclusion zones or relying on single-frame triggers without persistence.
- **Image Washout:** Exposure or image settings that wash out the visual appearance of smoke or fire.

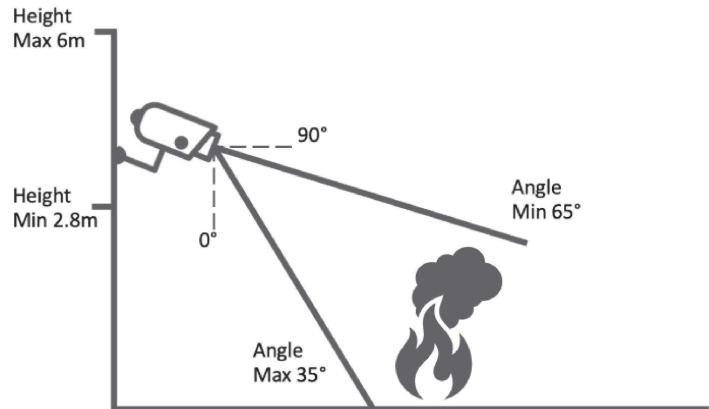
Technical Note

General Guidelines

The following guidelines should be used to provide optimal tracking and classification.

Camera Position and Angle

- **Minimum and Maximum height:** Minimum camera height of 2.8m from the ground plane and no higher than 6m. However, higher zoom lenses will increase these figures.
- **Stability:** Ensure cameras are mounted on a stable surface to avoid motion-induced false positives.
- **Tilt:** The camera view tilt angle (pitch) should be within $\sim 35^\circ$ of the horizontal.
- **Roll:** The camera's view roll angle should be within $\pm 10^\circ$ of the horizontal.
- **Fixed Cameras:** The tracker is designed for use with fixed cameras only.
- **Clear View:** Cameras should be positioned to maintain a clear, unobstructed view of likely ignition areas.



Obstructions

Camera scenes should be clear of environmental factors that can reduce object detection and tracking.

- **Exclusion Zones:** Defined exclusion zones should be used to mask irrelevant or nuisance regions (e.g., areas with known steam, flickering lights, or moving machinery that mimics smoke/fire).
- **Alarm Logic:** Alarm generation must be based on persistence-based alarming (detection over multiple frames or seconds) rather than isolated, single-frame triggers.

Class	Min Pixels on Target	Height %
Smoke	35px	7.4%
Fire	13px	2.6%

Image and Stream Settings

Image quality is essential for distinguishing smoke and fire from the background.

- **Resolution: Minimum 480p;** 720p or higher is recommended.
- **Frame Rate:** 15 FPS or higher.
- **Bitrate:** high bitrate to limit compression artifacts.
- **Contrast:** Settings (exposure, gain, contrast) must be tuned to allow strong visual contrast between the hazard and the background.

Technical Note

Detection Range

Physical detection range (in metres) will vary based on a camera's field of view, which is defined by the camera lens and focal point.

*The **pixels on target** value (at 480p resolution) indicates object size based on the number of pixels in the bounding box of a tracked object. This number is relative to the input resolution, VCAserver can report this number under [Burnt-in Annotation](#) settings. For example, a tracked person in a 480p RTSP stream will have a higher pixels on target value than the same person in a 240p RTSP stream from the same camera.*

*The **height %** is a relative measure of object size based on the approximate height of an object relative to the field of view. It will be the same regardless of input resolution.*

Frequently Asked Questions

Does the DLSF Tracker learn while in use?

No. The tracker uses a pre-trained deep learning model created using large sets of reference data. It does not "learn" or adapt to your specific scene during operation.

What image settings should I use?

To achieve the best results, ensure the camera is not over-exposed. Smoke and fire must remain visually distinct. Use a resolution of at least 480p and a frame rate of 15 FPS to ensure the temporal characteristics of smoke and fire are captured accurately.

Will it detect steam or fog?

While the model is trained to distinguish smoke, environmental factors like heavy steam or fog may reduce performance. The use of exclusion zones and persistence-based alarm logic is highly recommended to filter out these nuisance alerts.

Setup

The Deep Learning Smoke and Fire Tracker (DLSF) is active on the channel as soon as it is selected. On first use, the tracker optimises to the available GPU(s). Depending on the GPU, this process can take up to 45 minutes to complete. During this initialisation process, a message is displayed on the channel preview page.

The tracker assesses every frame being delivered, regardless of activity. This means that the GPU loading will be constant.

Technical Note

General

- The Deep Learning Smoke and Fire Tracker (DLSF) is controlled through licensing. Ensure the correct license has been activated on the system.
- Licenses are assigned to channels. Ensure the correct license is assigned to the channel.
- Ensure you have selected the correct tracker for your application.
- Ensure a good-quality image is being delivered to the analytic engine.
- Any object that can be classified will be identified and tracked, use *object filters* to control which objects will trigger an event.
- Check that the prerequisites are installed and working correctly. The Deep Learning Smoke and Fire Tracker (DLSF) requires an Nvidia graphics card or DeepX Accelerator.

Note: More information on the exact requirements can be found in our support portal, in the manual and through the hardware requirements document. (<https://vcatechnology.com/downloads/>)