



IMPROVING THE CHRONOLOGICAL SORTING OF IMAGES THROUGH OCCLUSION: A STUDY ON THE NOTRE-DAME CATHEDRAL FIRE

Rafael Padilha, Fernanda A. Andaló, Anderson Rocha

{rafael.padilha, feandalo, anderson.rocha}@ic.unicamp.br

Institute of Computing - University of Campinas (UNICAMP)





NOTRE-DAME CATHEDRAL FIRE

APRIL 2019 - PARIS (FR)



NOTRE-DAME CATHEDRAL FIRE

TOP NEWS-RELATED #HASHTAG WORLDWIDE IN 2019



NOTRE-DAME CATHEDRAL FIRE

TOP NEWS-RELATED #HASHTAG WORLDWIDE IN 2019



In this sea of unorganized data arisen from an event:

How can we chronologically sort these media pieces?



EVENT

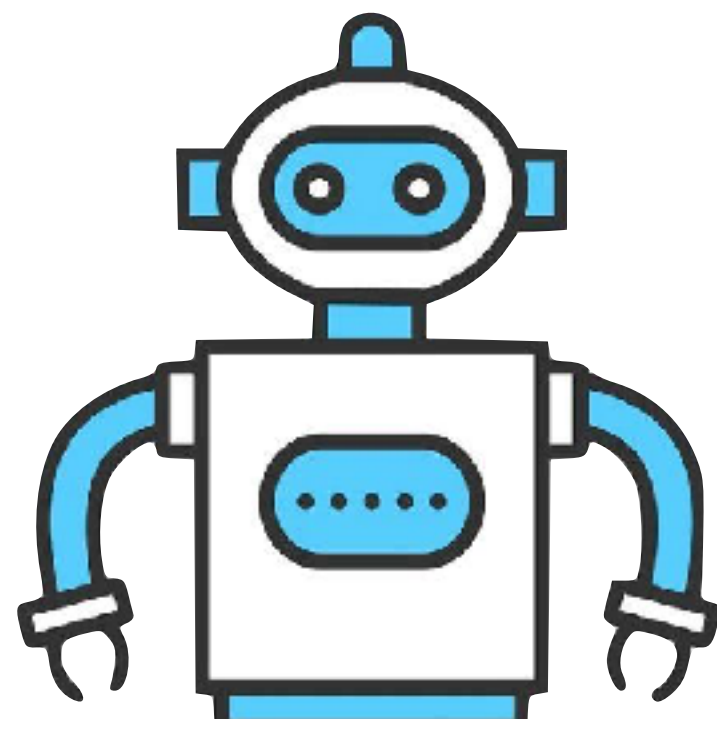
UNDERSTANDING

RECONSTRUCTION

FACT-CHECKING

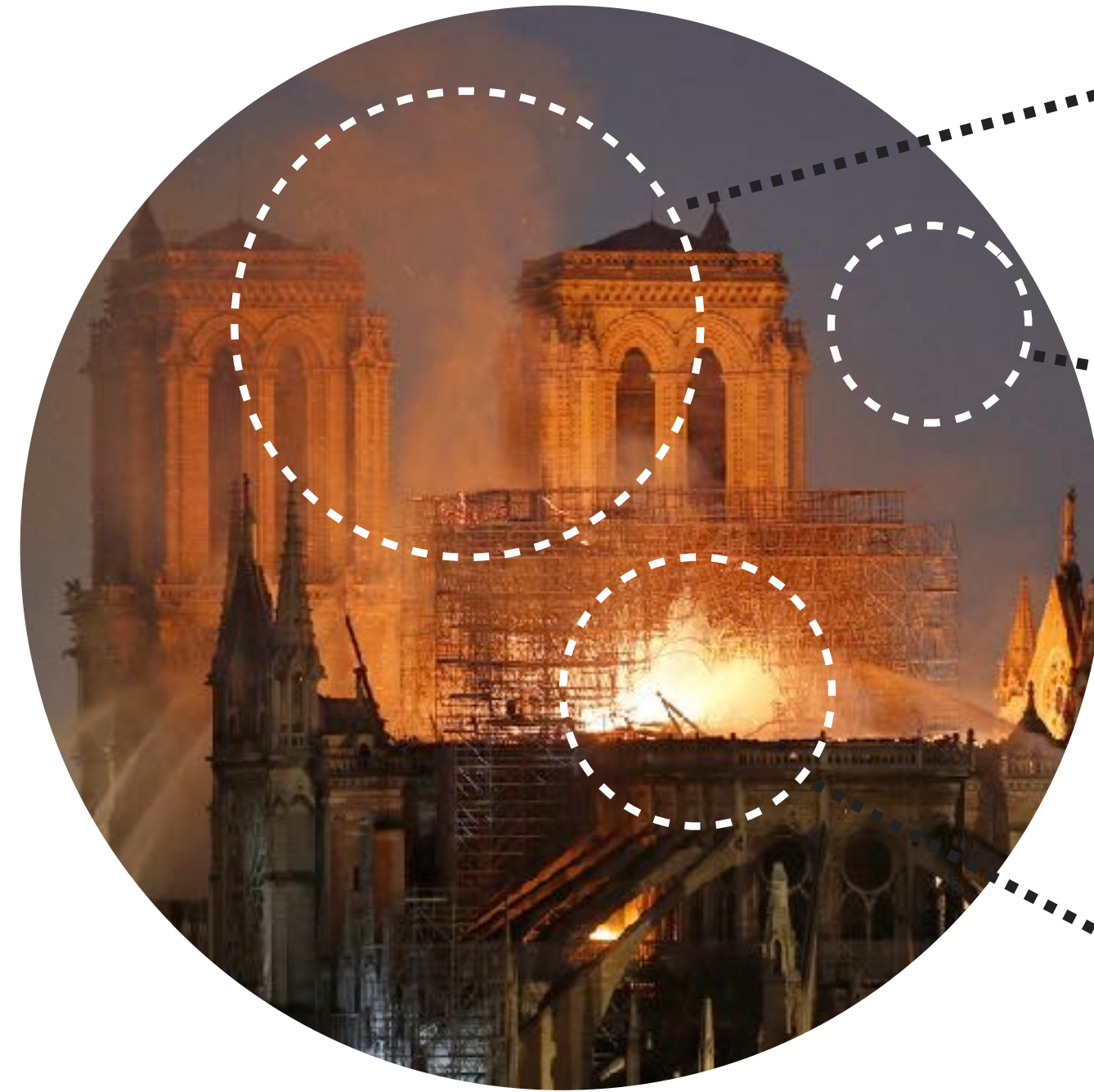


TIME



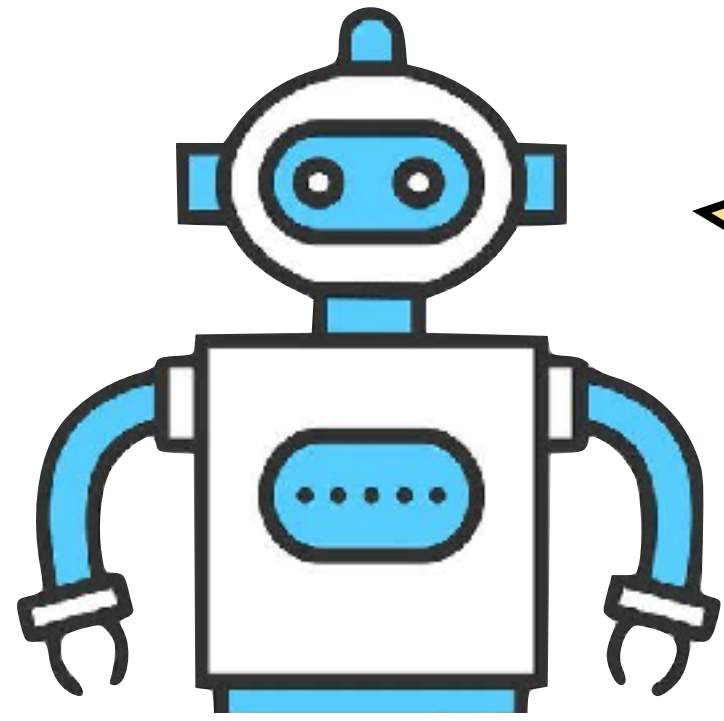
THIS WAS CAPTURED AROUND 6PM, BECAUSE ...

NO SIGN OF
CENTRAL SPIRE



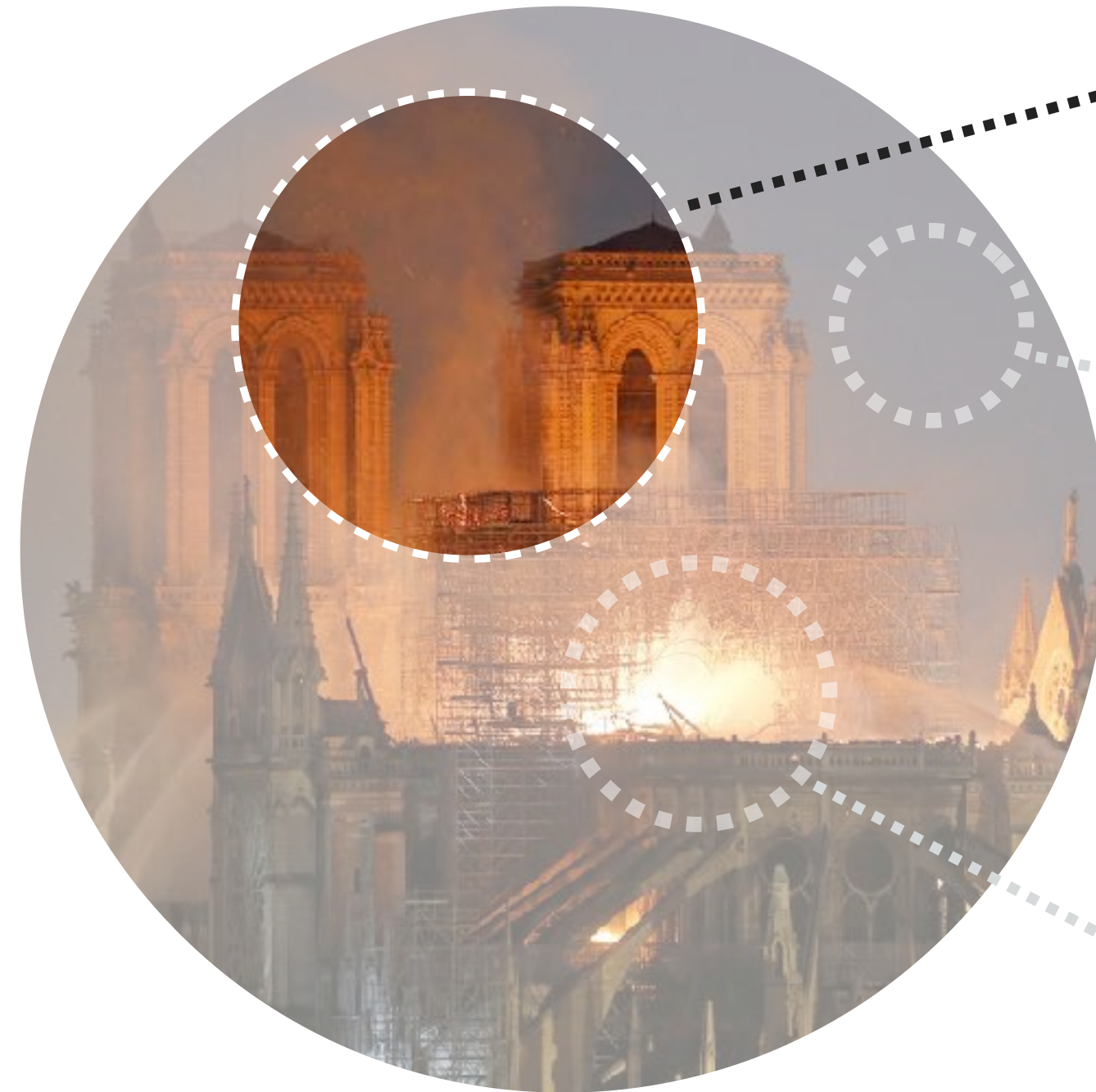
NIGHT SKY

PRESENCE OF FIRE



6PM, THE CENTRAL SPIRE
HAD ALREADY COLLAPSED!

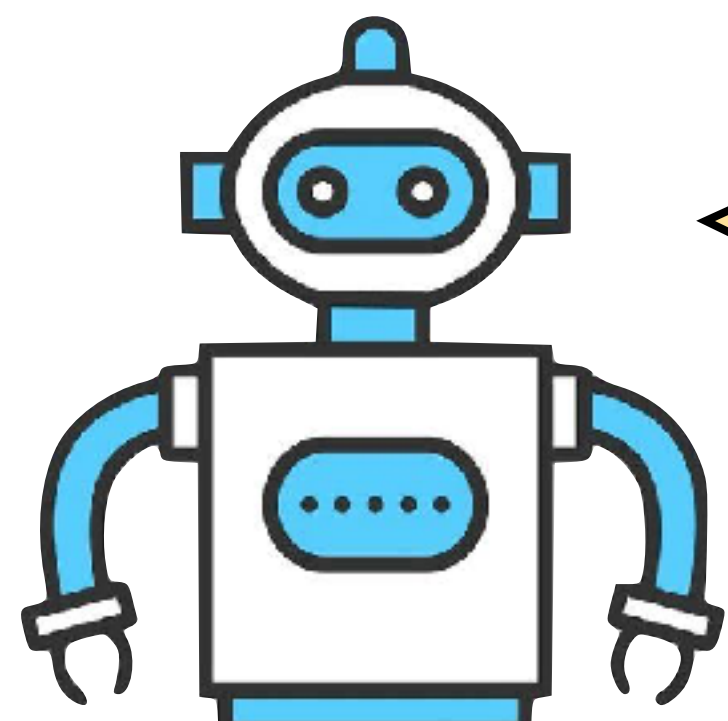
NO SIGN OF
CENTRAL SPIRE



NIGHT SKY

PRESENCE OF FIRE

ADVERSARIAL ERASING STRATEGY



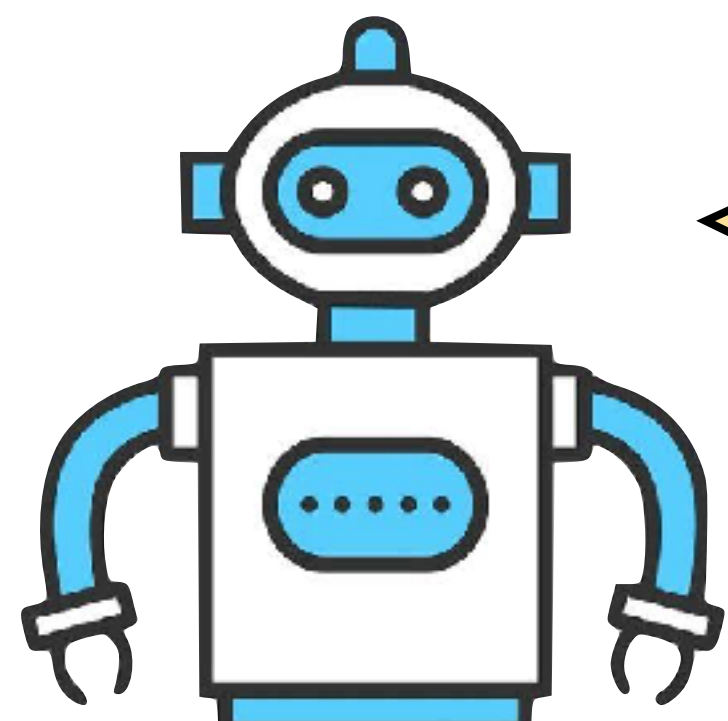
STILL 6PM, LOOK AT THE FIRE!

INFERENCE

TRAINING



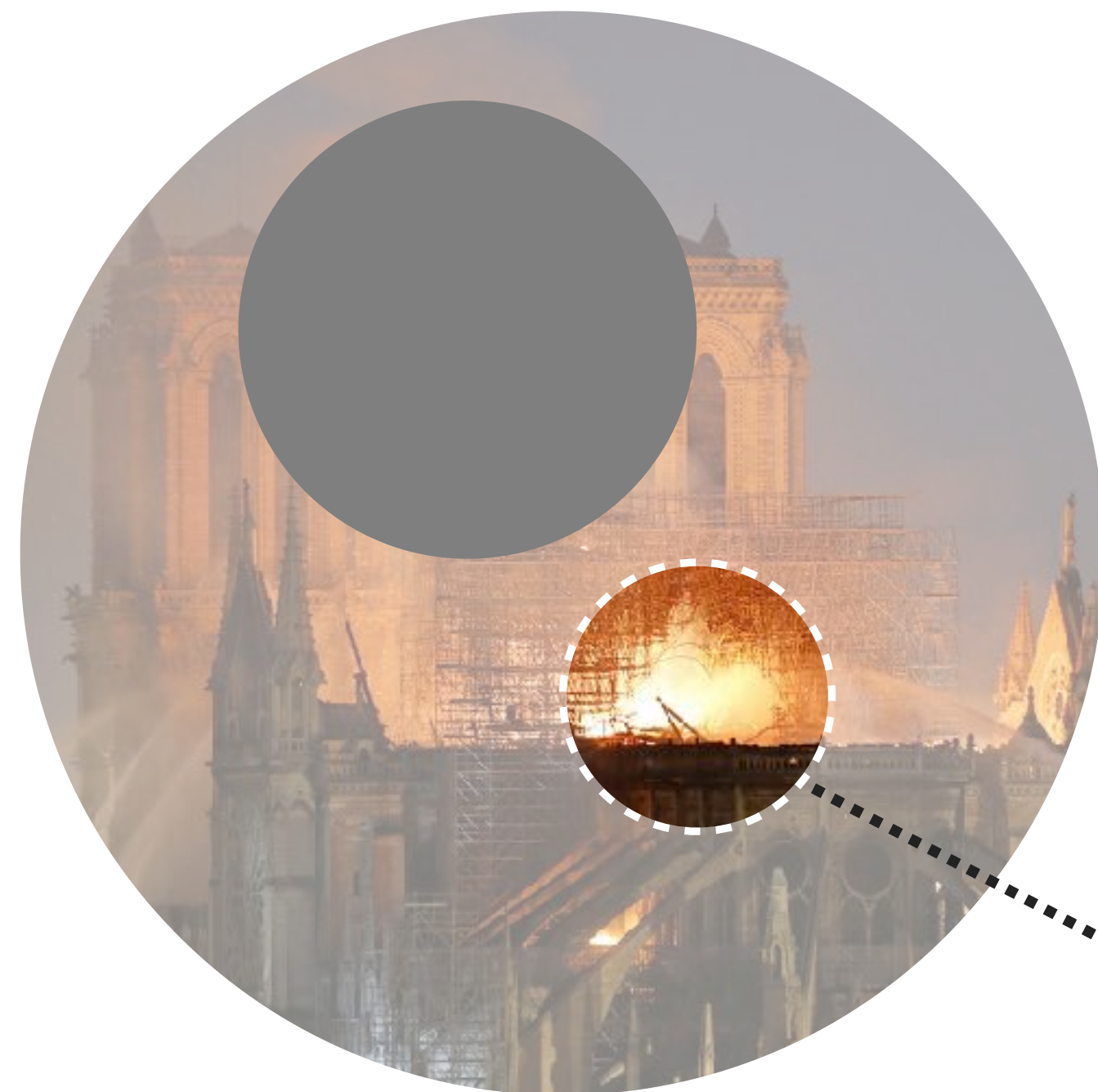
ADVERSARIAL ERASING STRATEGY



STILL 6PM, LOOK AT THE FIRE!

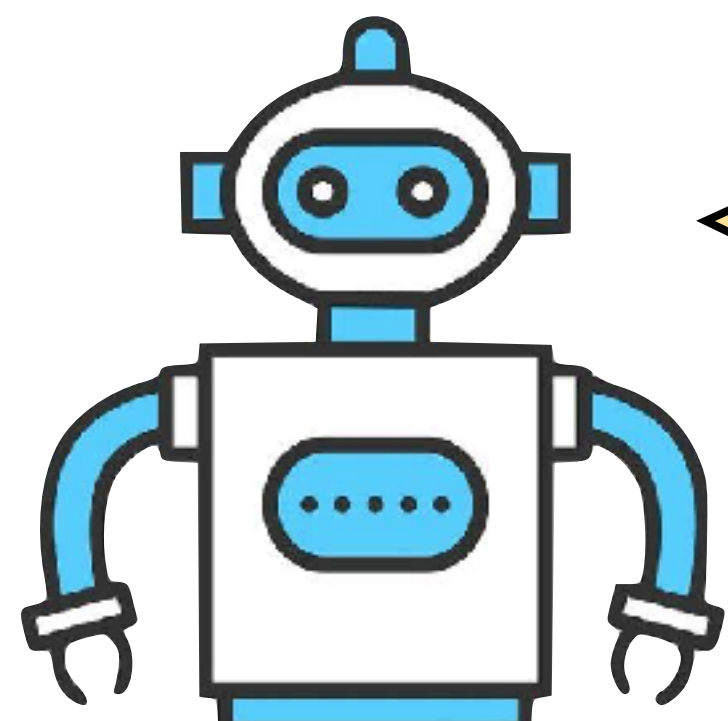
INFERENCE

TRAINING



PRESENCE OF FIRE

ADVERSARIAL ERASING STRATEGY



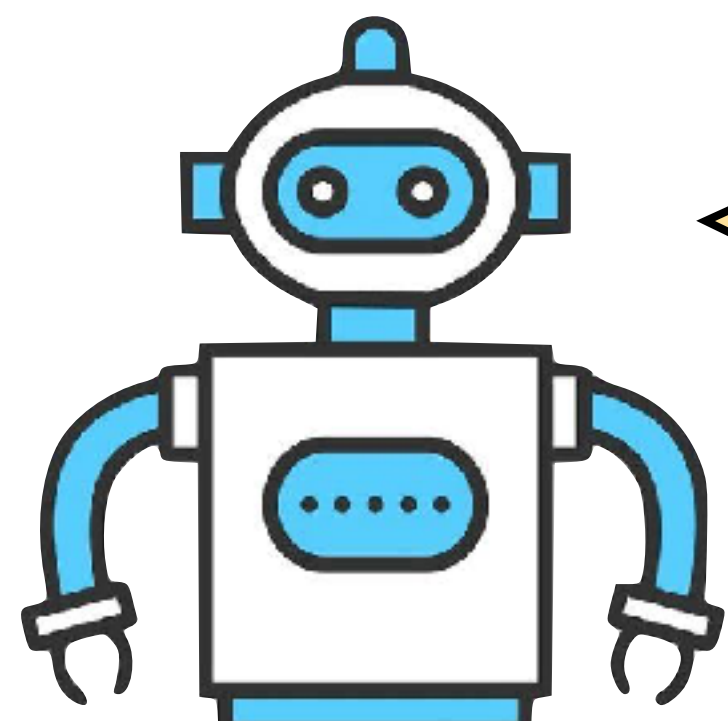
THE PARISIAN SKY!
OBVIOUSLY IT'S 6PM

INFERENCE

TRAINING



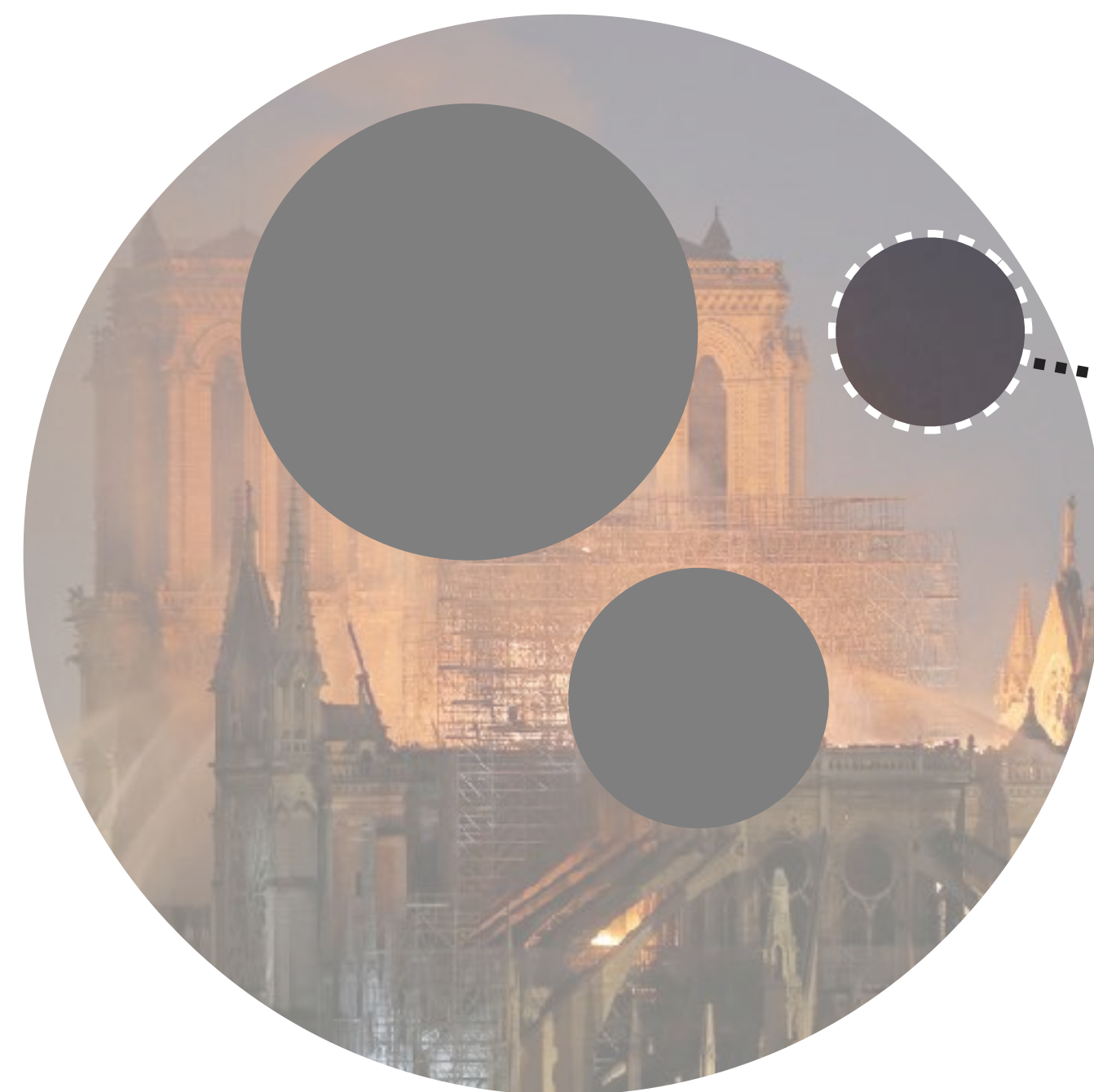
ADVERSARIAL ERASING STRATEGY



THE PARISIAN SKY!
OBVIOUSLY IT'S 6PM

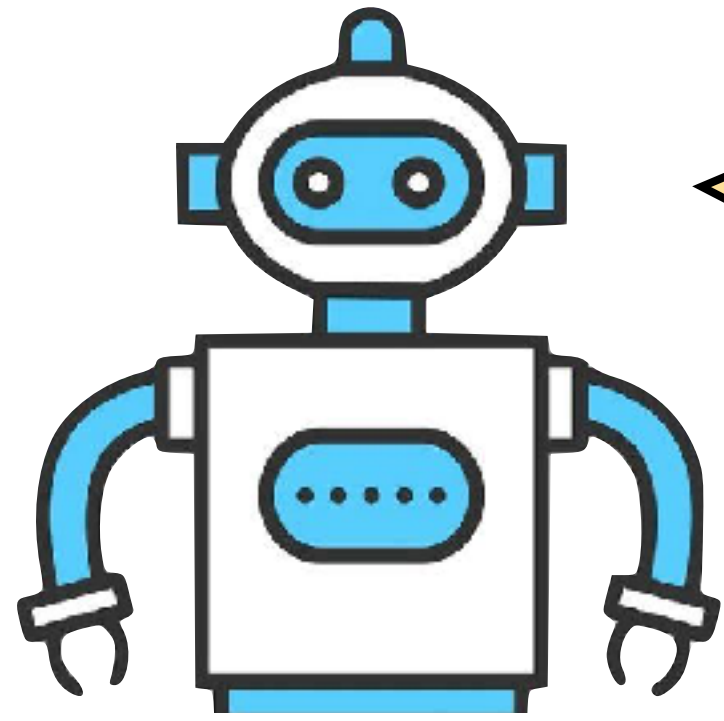
INFERENCE

TRAINING



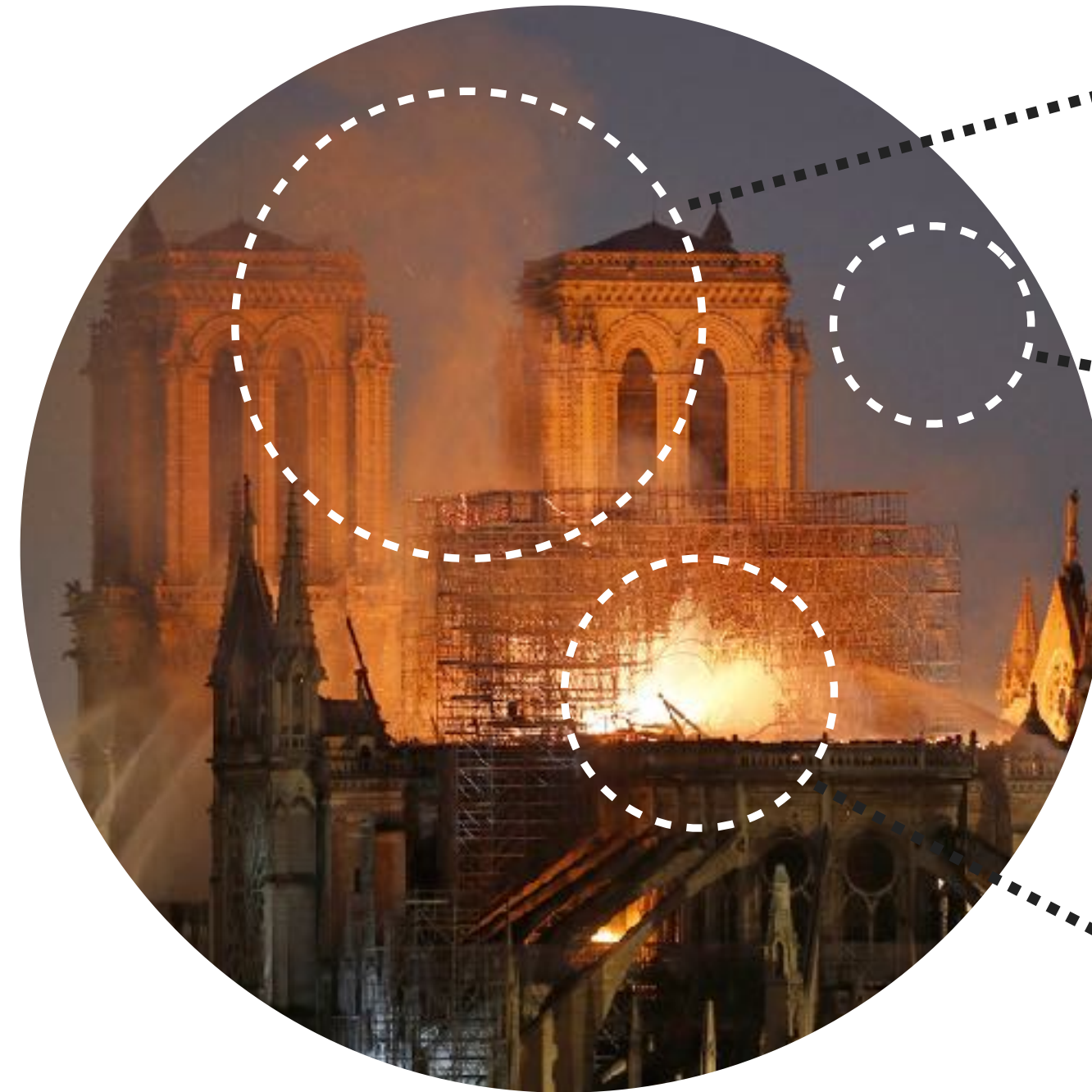
NIGHT SKY

ADVERSARIAL ERASING STRATEGY



I KNOW THIS! 6PM
ALREADY NIGHT, BUT THERE IS
STILL FIRE AND NO SPIRE!

NO SIGN OF
CENTRAL SPIRE



NIGHT SKY

PRESENCE OF FIRE

ADVERSARIAL ERASING STRATEGY

MAIN CONTRIBUTIONS

Use of occlusion to improve chronological sorting of images:

Adversarial Erasing Strategy

Non-activating Occlusion

Random Occlusion

Guided Occlusion

Improve the accuracy of chronological sorting

Obtain better insights for the network decision

MAIN CONTRIBUTIONS

Dataset of 1,657 images from the Notre-Dame Cathedral Fire event



Spire on Fire



Spire Collapsing



Fire continues on the roof



Fire extinguished

Available for download in: <https://bit.ly/NotreDameDataset>

NOTRE-DAME CATHEDRAL FIRE DATASET



23,000+ IMAGES



#NotreDameDeParis

#NotreDameFire

#ParisFire

#NotreDameCathedral

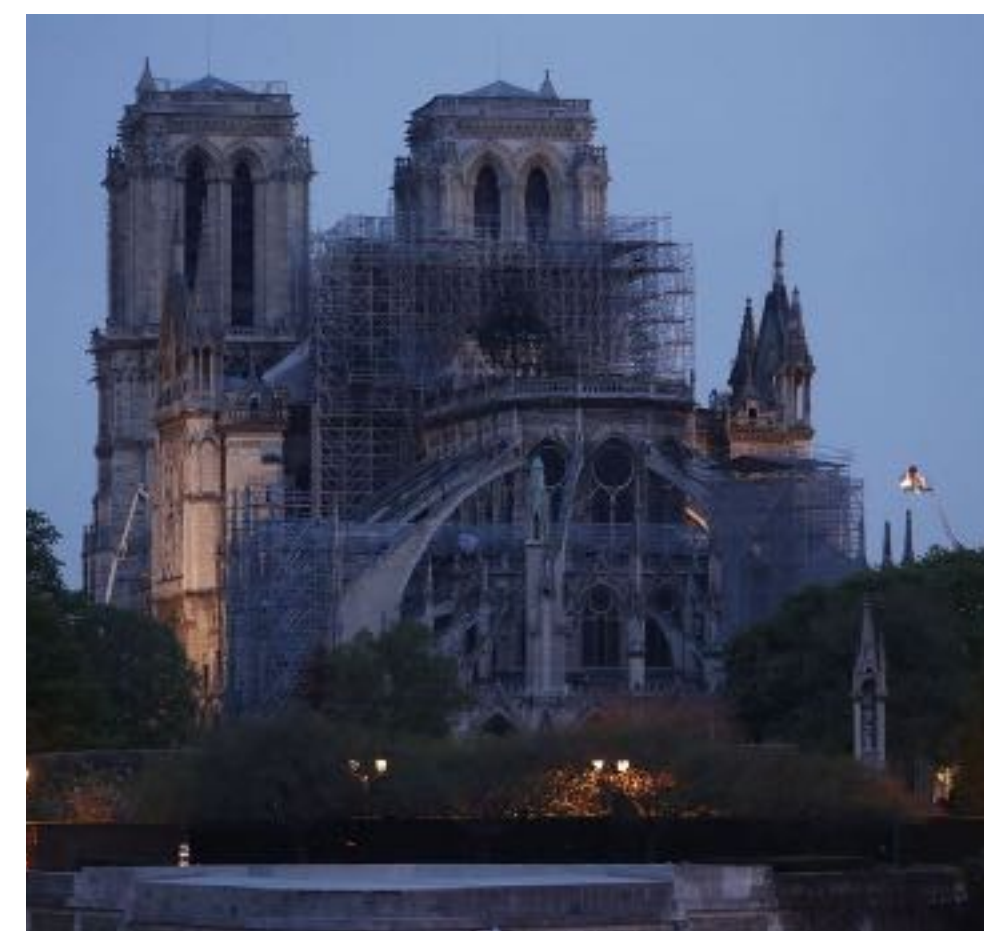
#NotreDame

23,000+ IMAGES



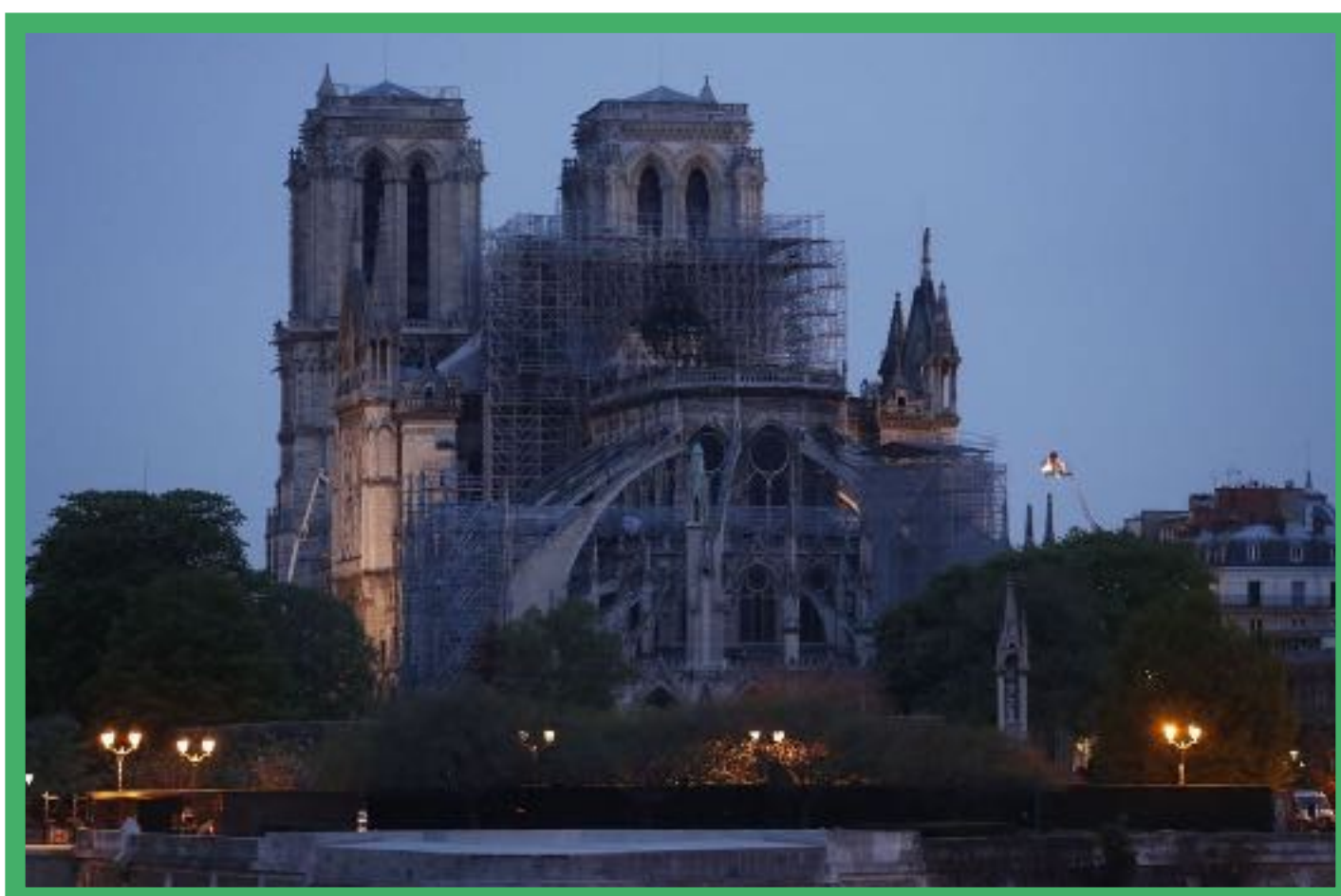
NOTRE-DAME CATHEDRAL FIRE - DATASET

5,200+ IMAGES



NOTRE-DAME CATHEDRAL FIRE - DATASET

5,200+ IMAGES

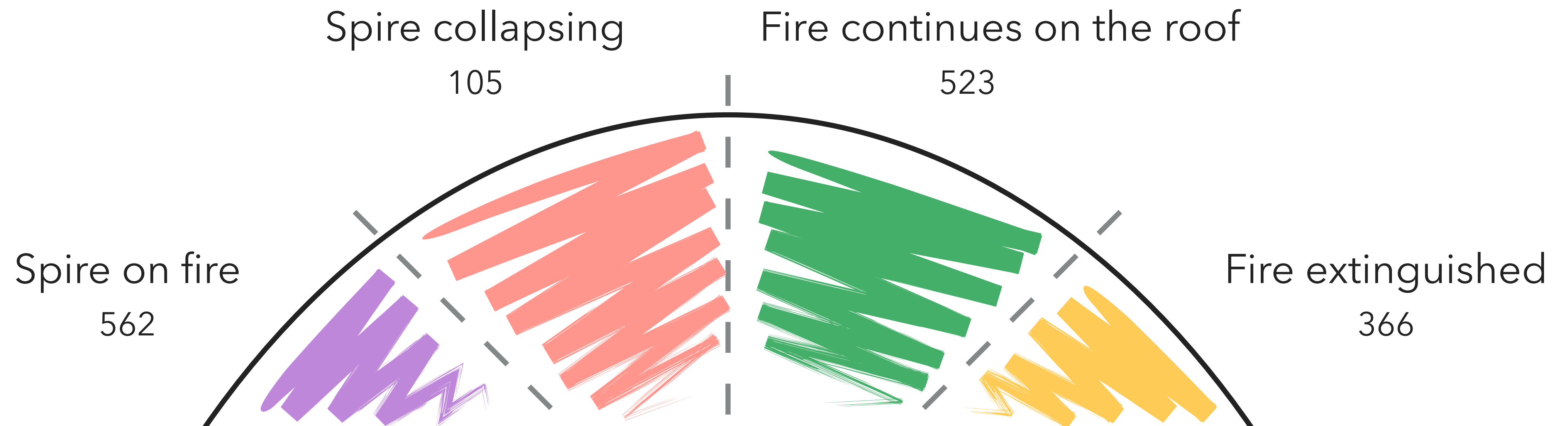


NOTRE-DAME CATHEDRAL FIRE - DATASET

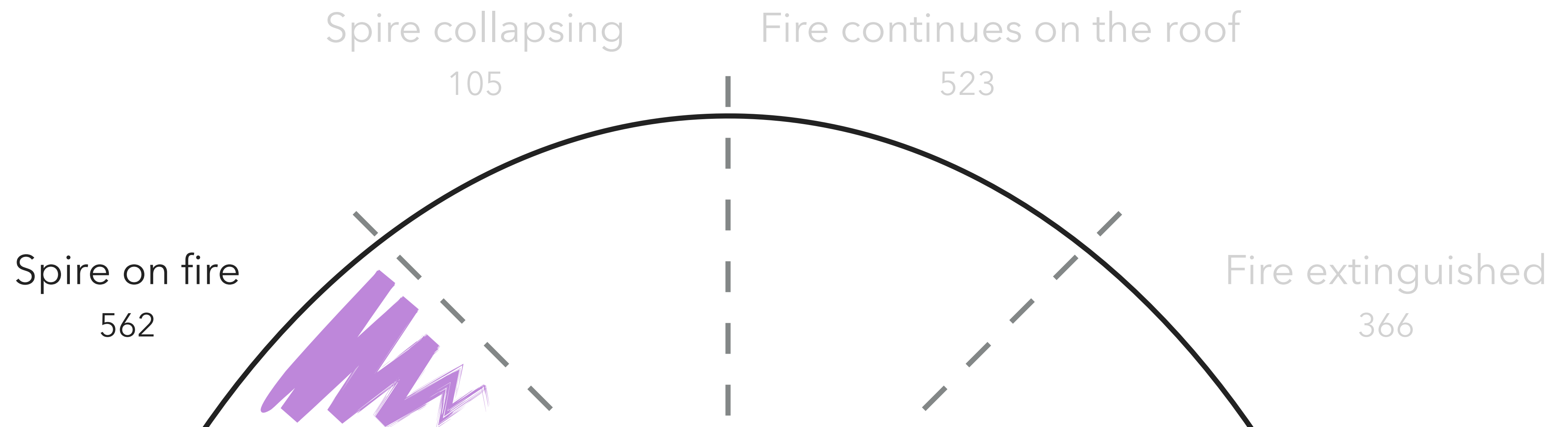
1,600+ IMAGES



MOMENTS IN TIME



NOTRE-DAME CATHEDRAL FIRE - DATASET



NOTRE-DAME CATHEDRAL FIRE - DATASET



Spire collapsing

105

Fire continues on the roof

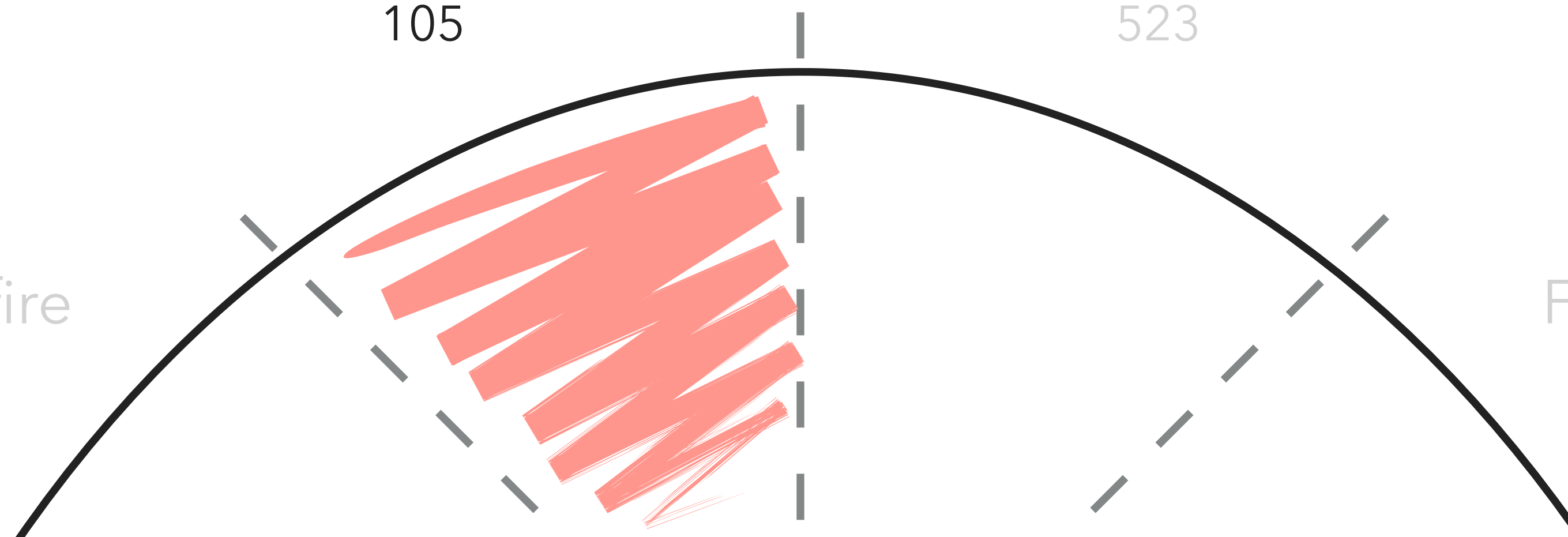
523

Spire on fire

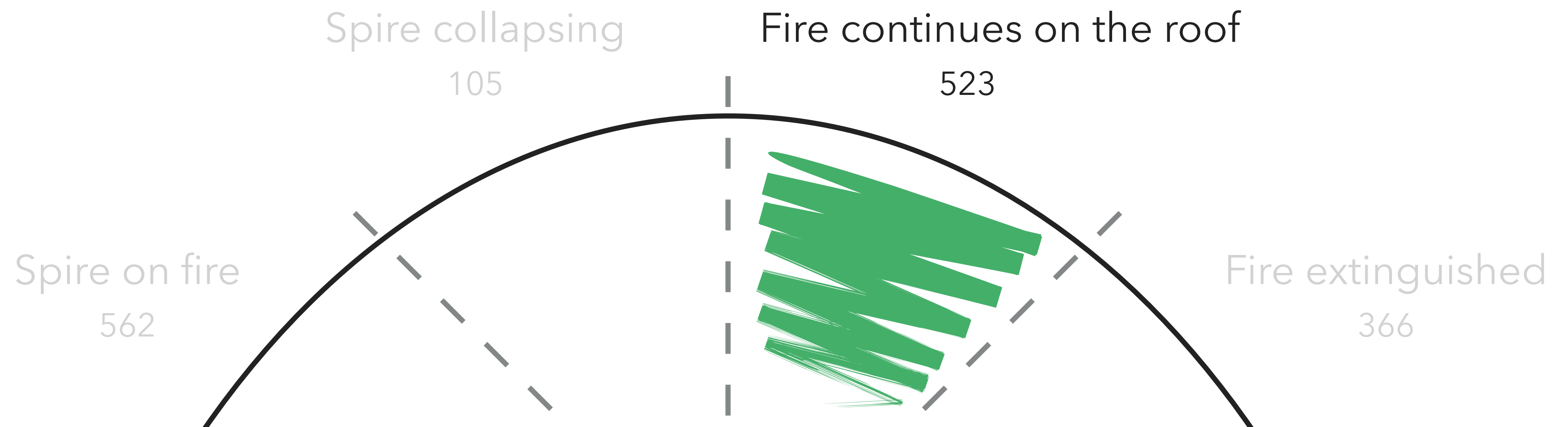
562

Fire extinguished

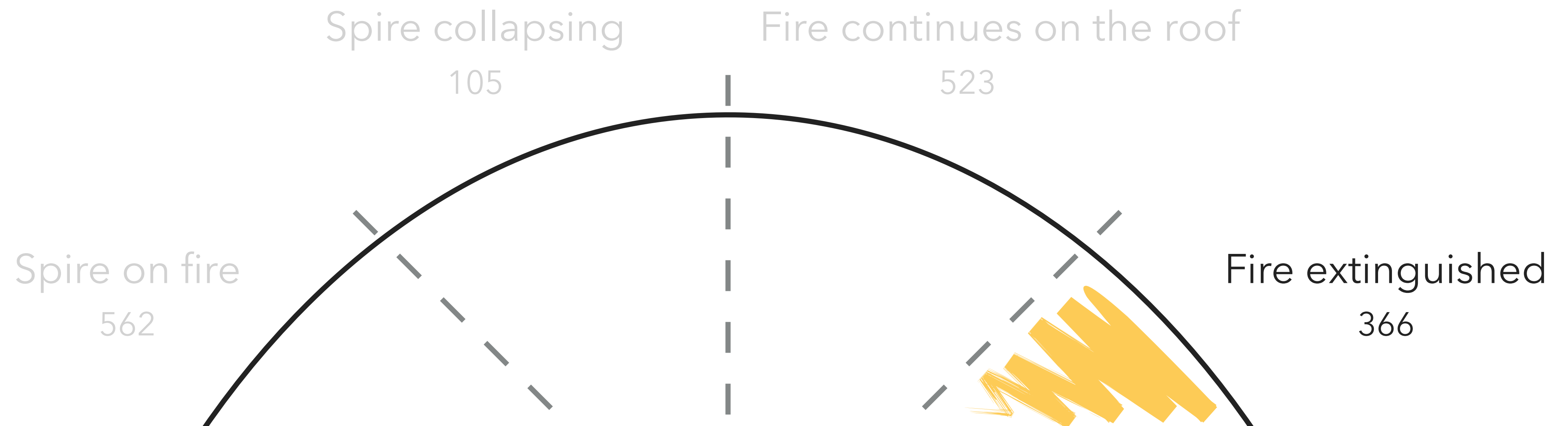
366



NOTRE-DAME CATHEDRAL FIRE - DATASET



NOTRE-DAME CATHEDRAL FIRE - DATASET

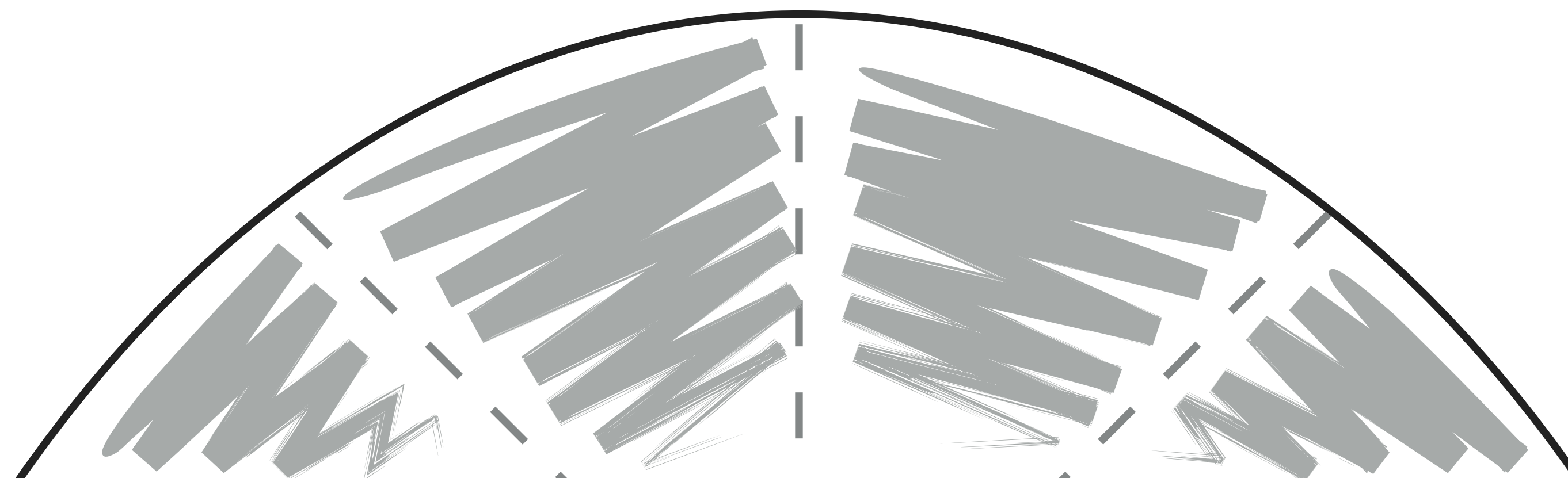


NOTRE-DAME CATHEDRAL FIRE - DATASET

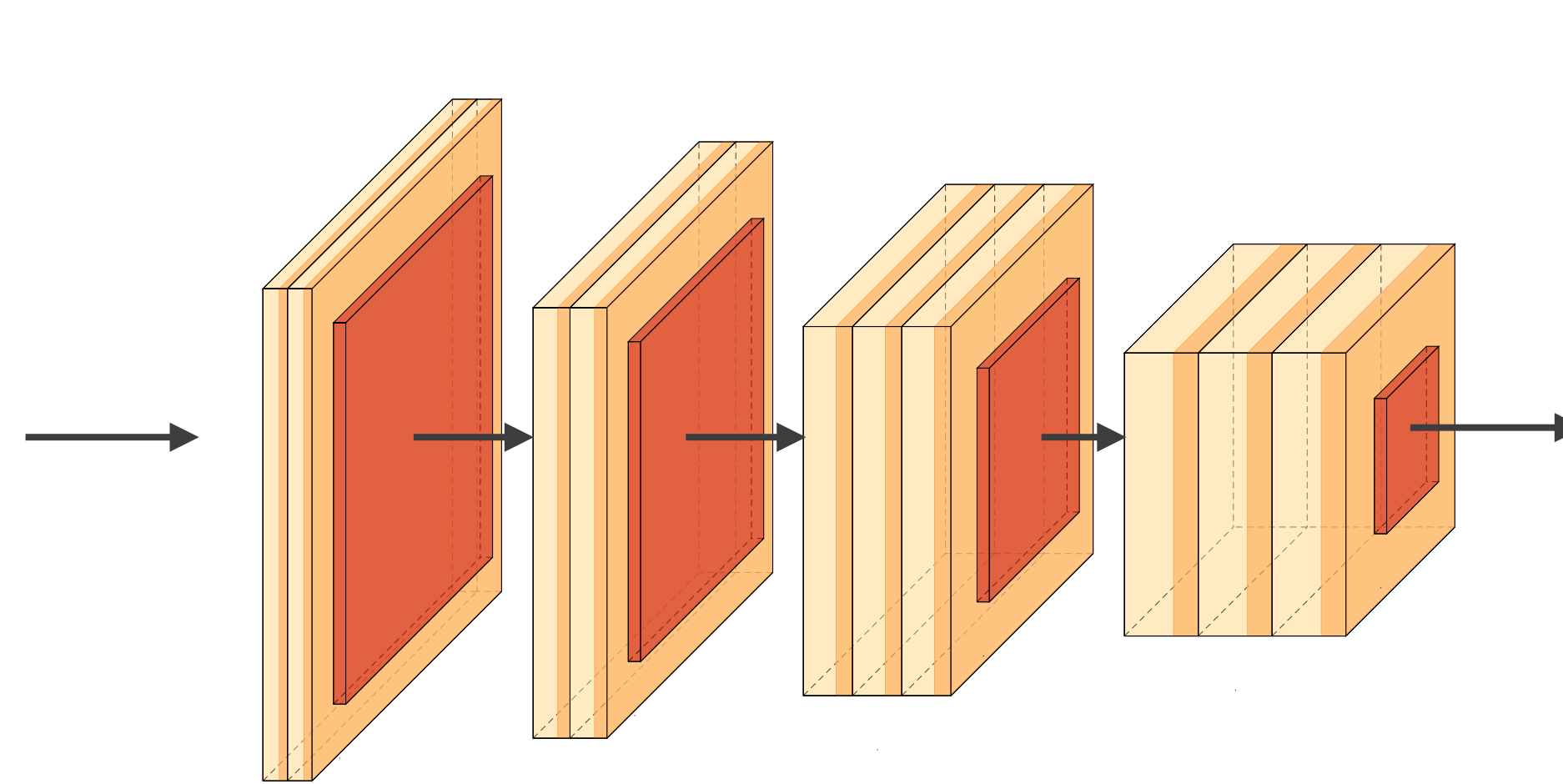


Unknown

101



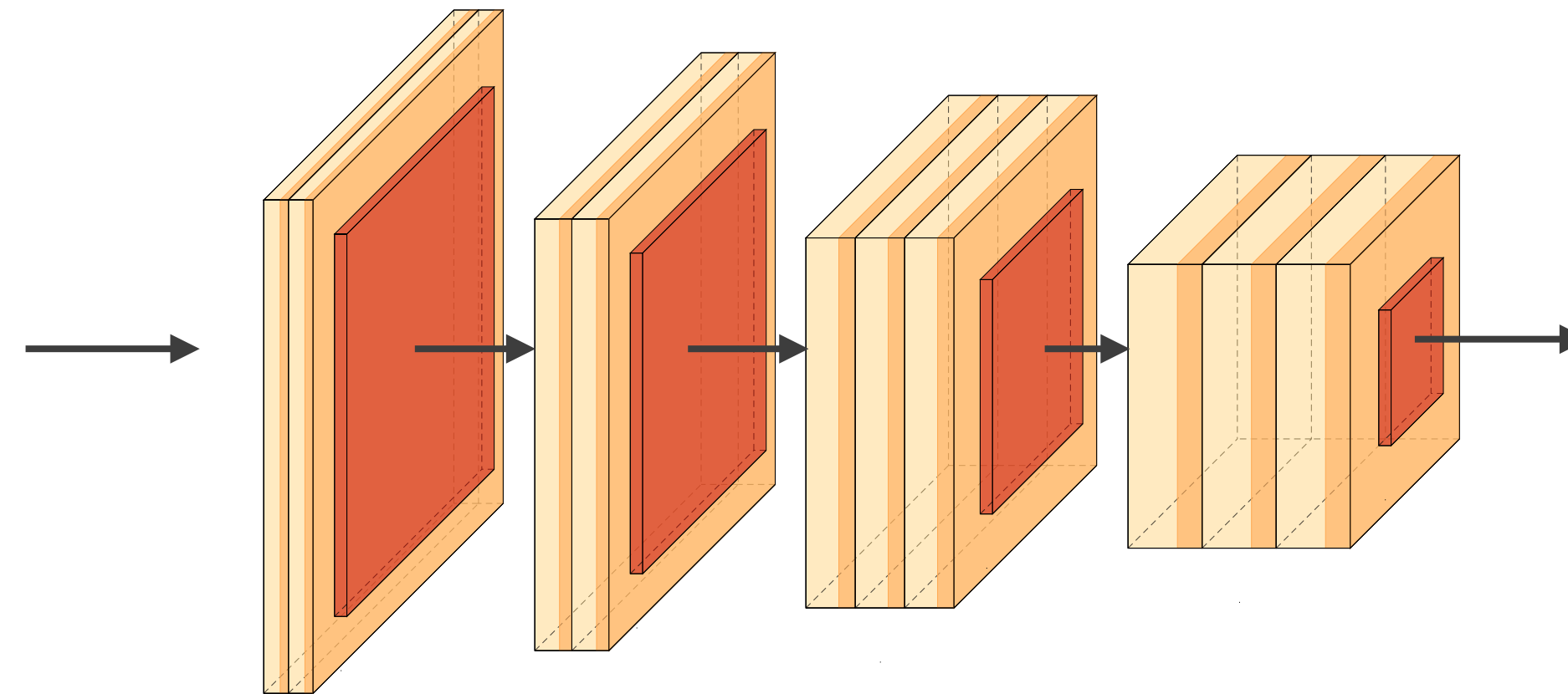
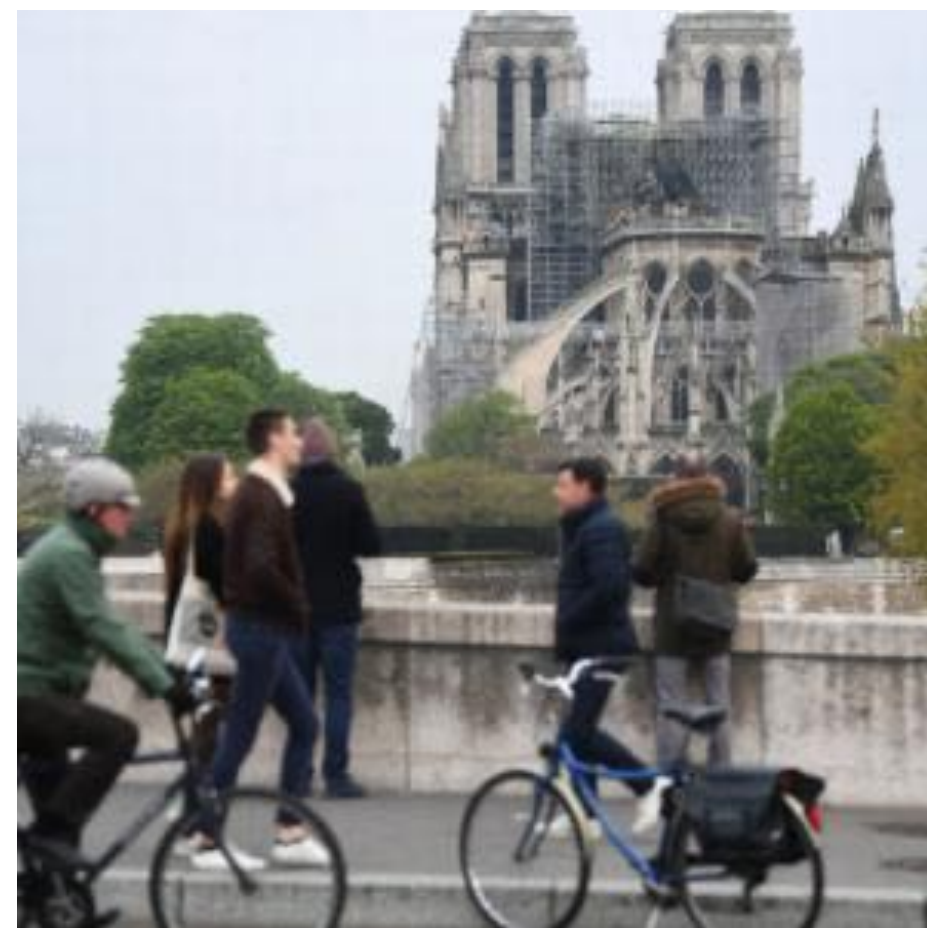
MULTI-CLASS CLASSIFICATION



- Spire on fire
- Spire collapsing
- Fire continues on the roof
- Fire extinguished
- Unknown

CONVOLUTIONAL NEURAL NETWORK

MULTI-CLASS CLASSIFICATION



Fire extinguished



CLASS ACTIVATION MAP

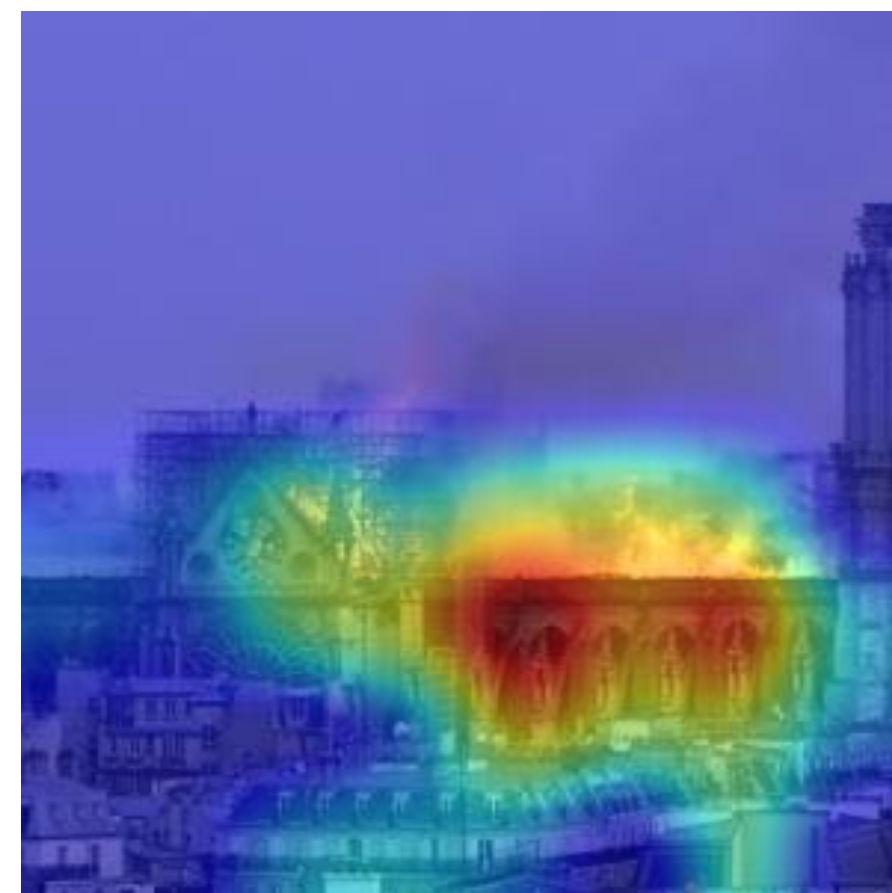
ACTIVATION MAPS



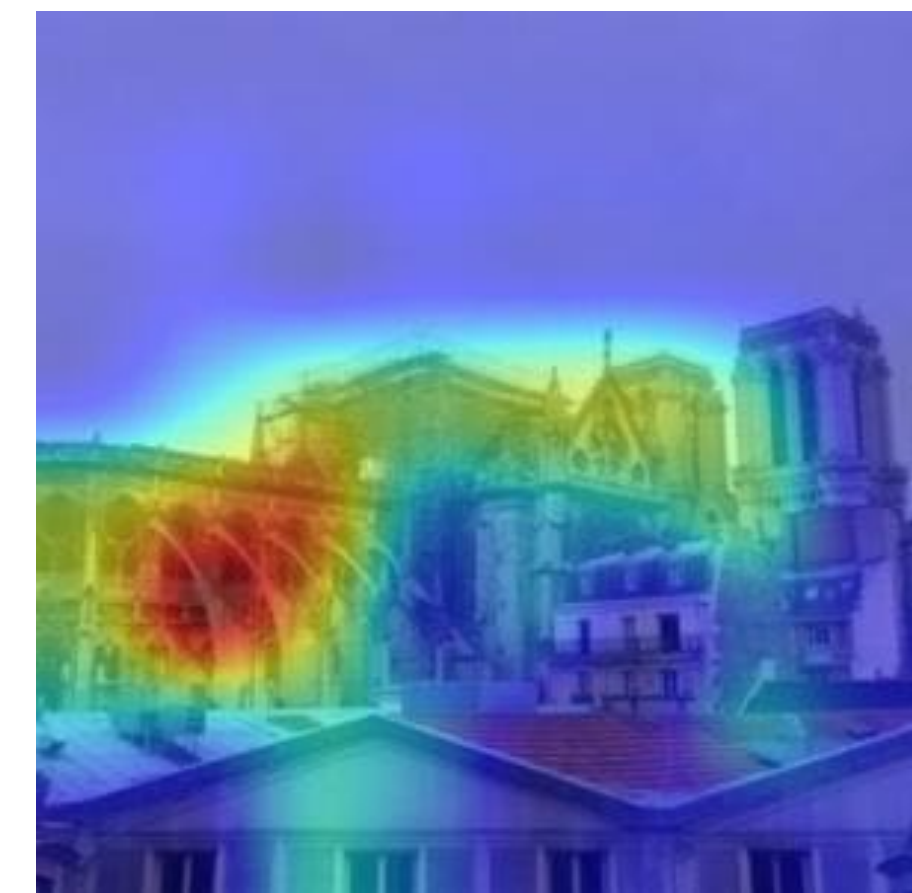
Spire on fire



Spire collapsing



Fire continues on the roof

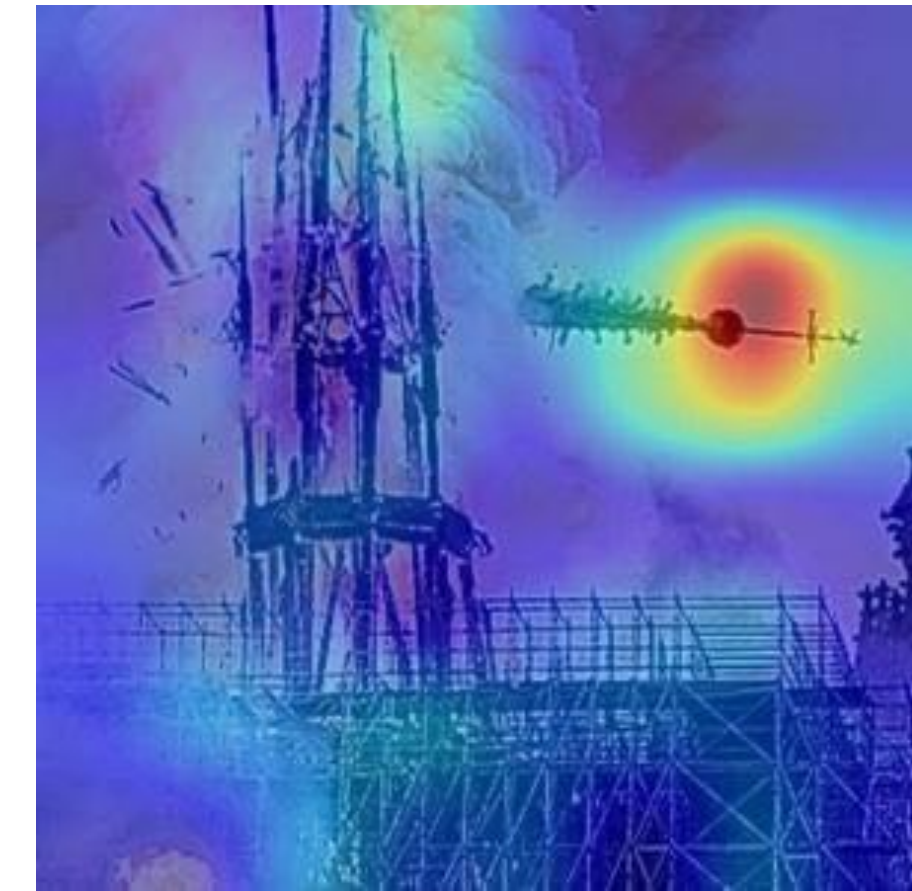


Fire extinguished

ACTIVATION MAPS



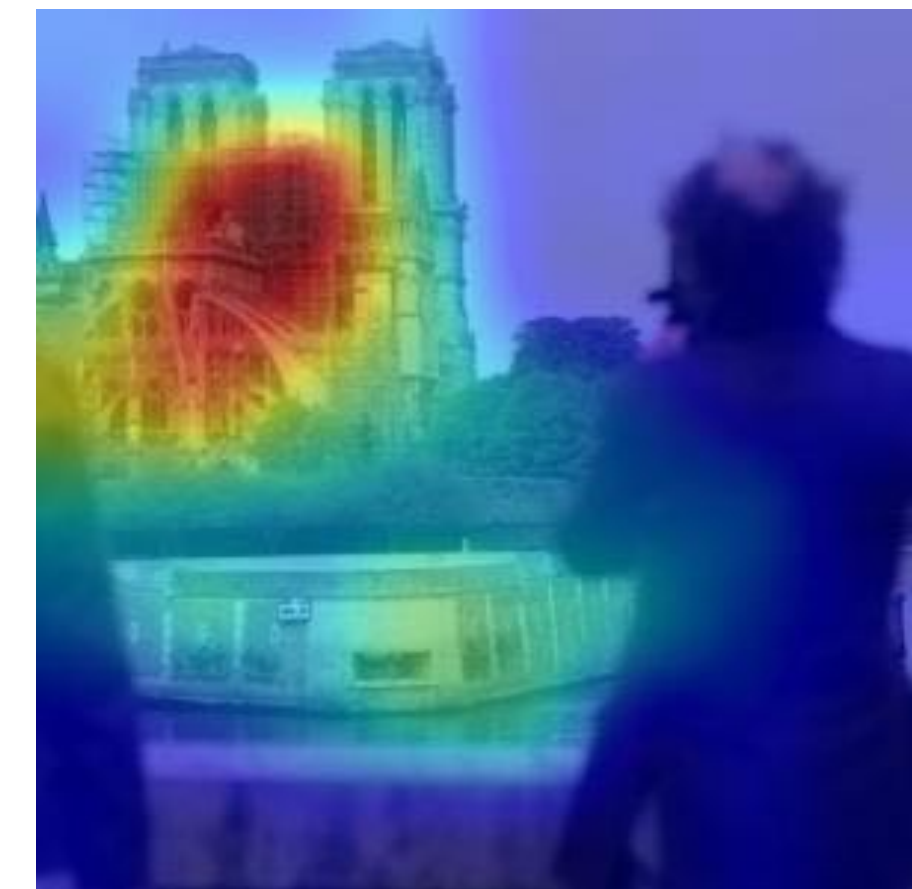
Spire on fire



Spire collapsing

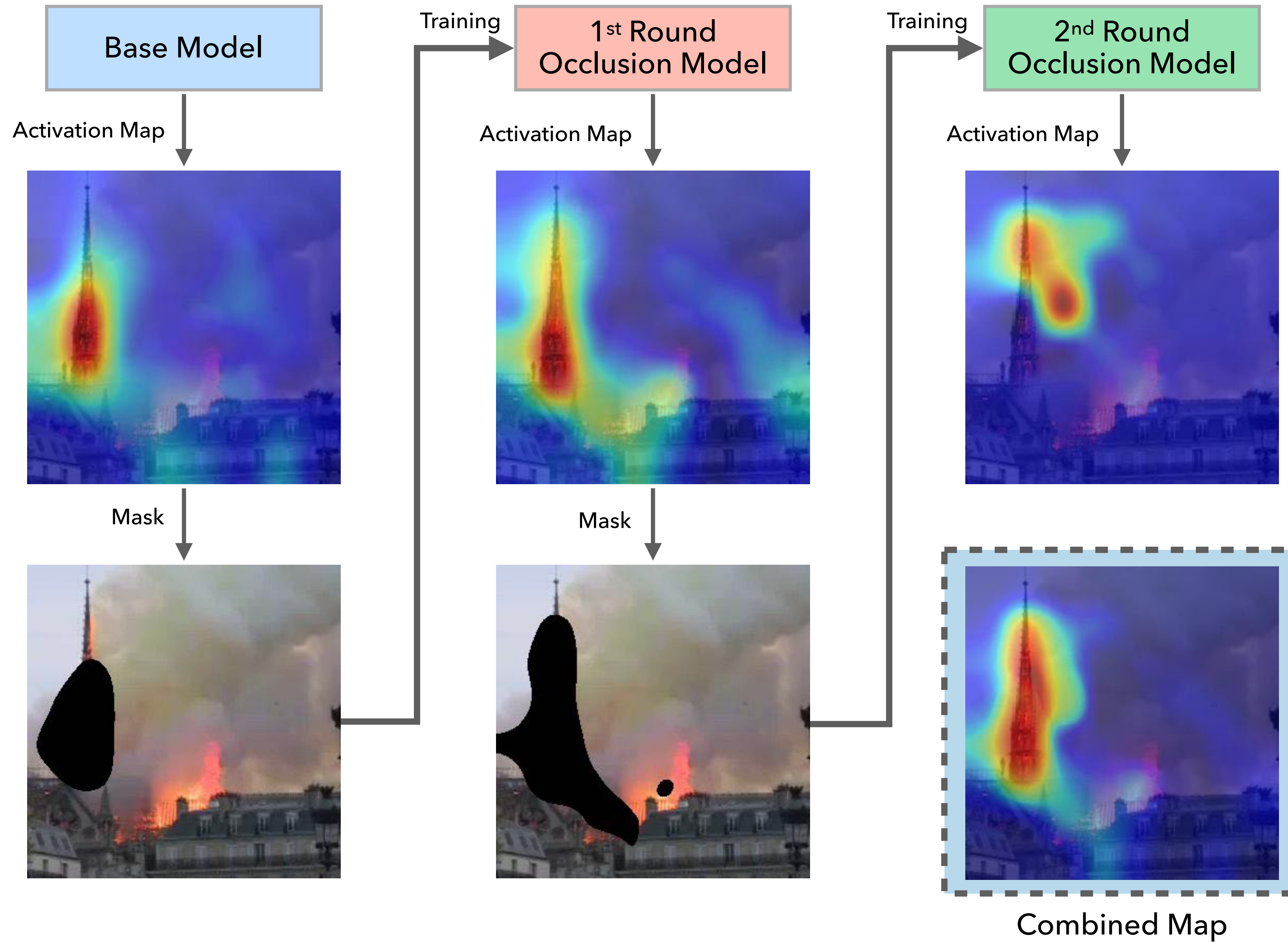


Fire continues on the roof

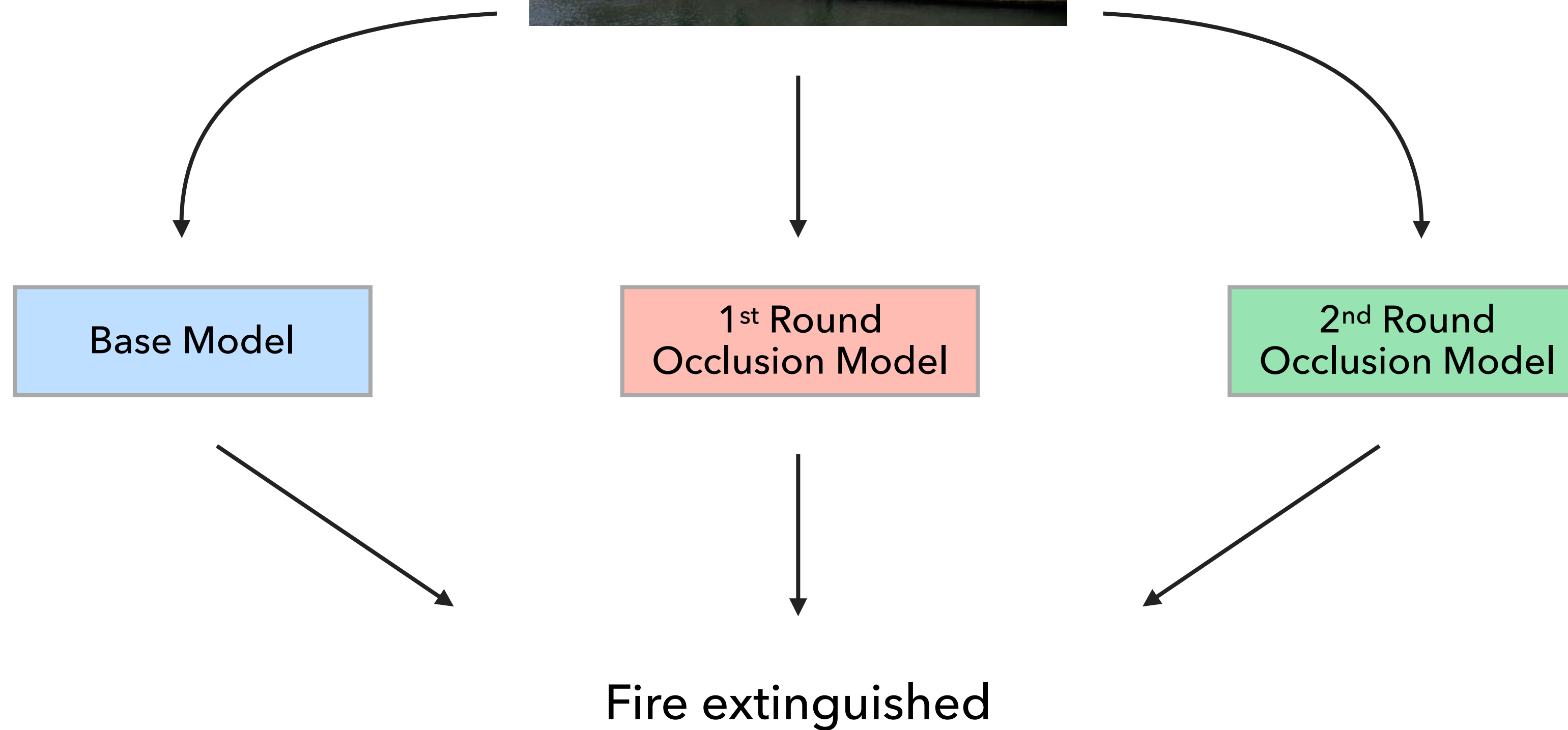


Fire extinguished

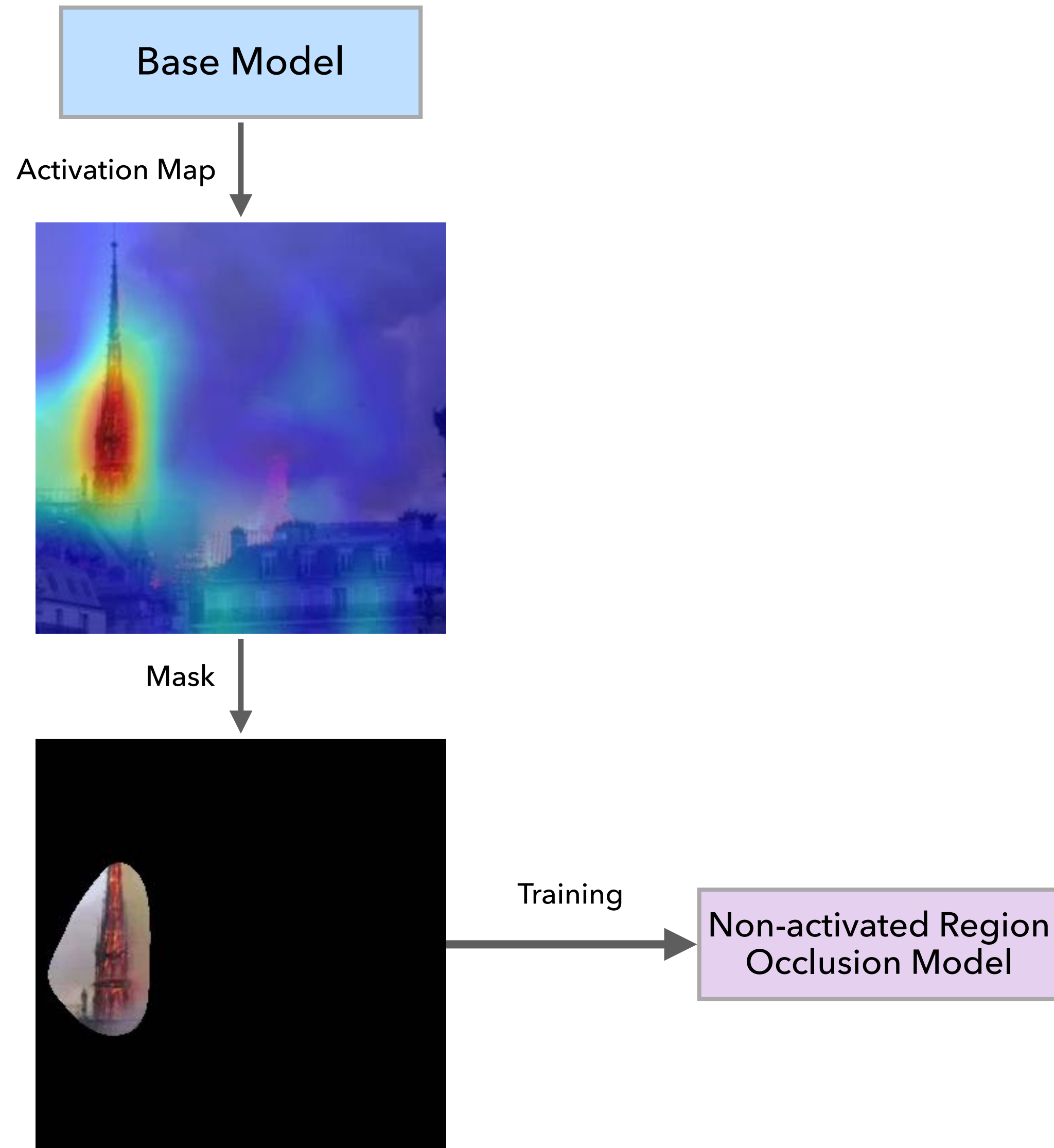
ADVERSARIAL ERASING STRATEGY



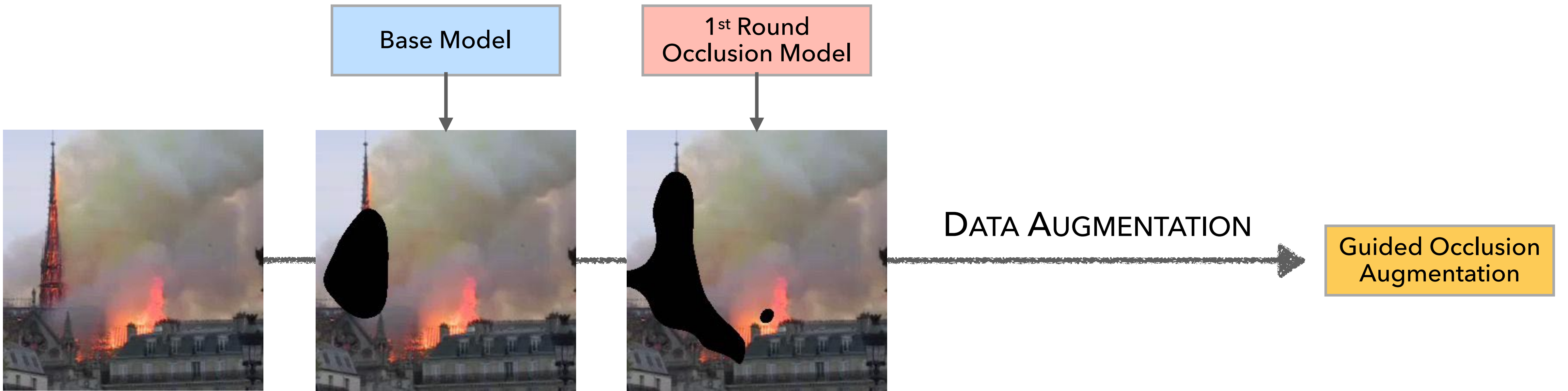
ADVERSARIAL ERASING STRATEGY



NON-ACTIVATED REGION OCCLUSION



OCCLUSION AS DATA AUGMENTATION

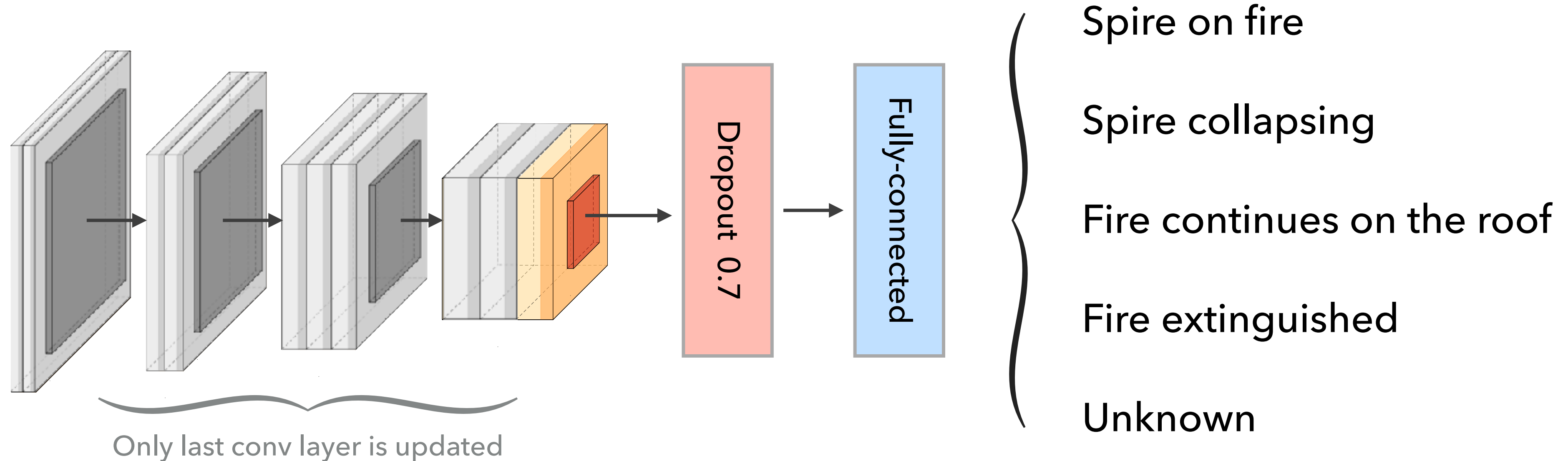


COVERING 10% TO 45% OF IMAGE IN RANDOM POSITION



TRAINING DETAILS

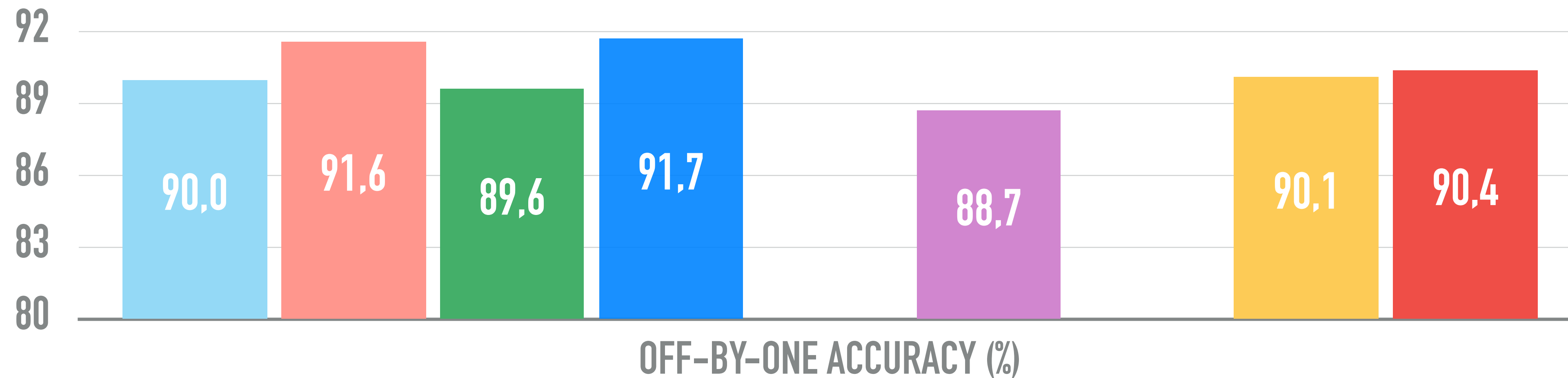
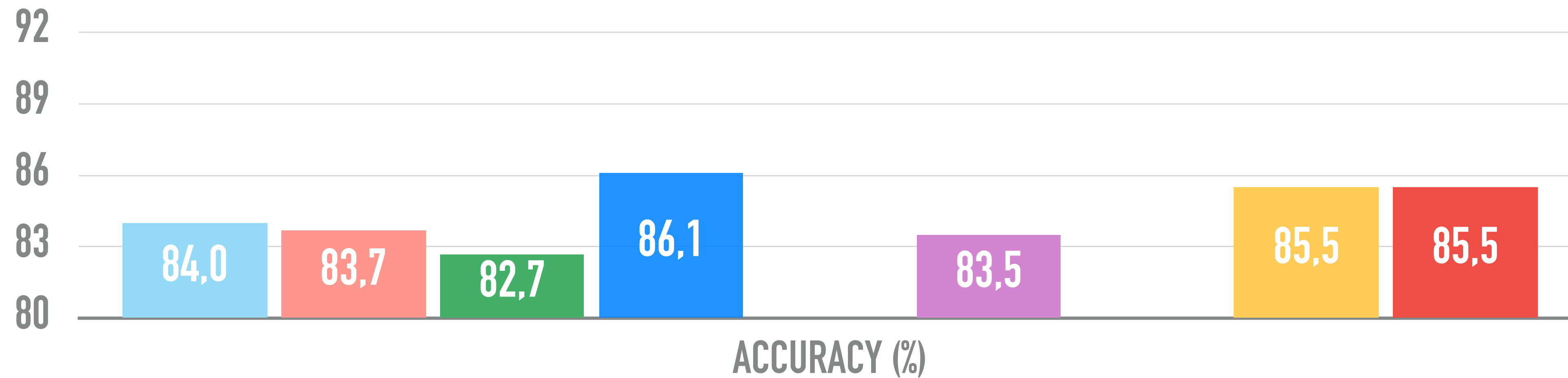
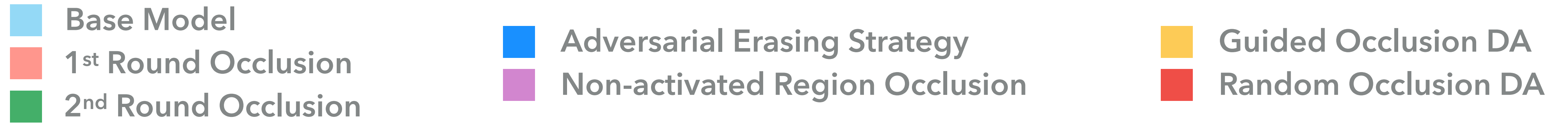
Inception-ResNet V2 (ImageNet weights)



Adam optimizer (learning rate = 0.0001, $\beta_1 = 0.9$, $\beta_2 = 0.999$)

Data augmentation (rotation, horizontal flip, random scale and crop)

NOTRE-DAME CATHEDRAL FIRE - RESULTS



Original Image

Base Model

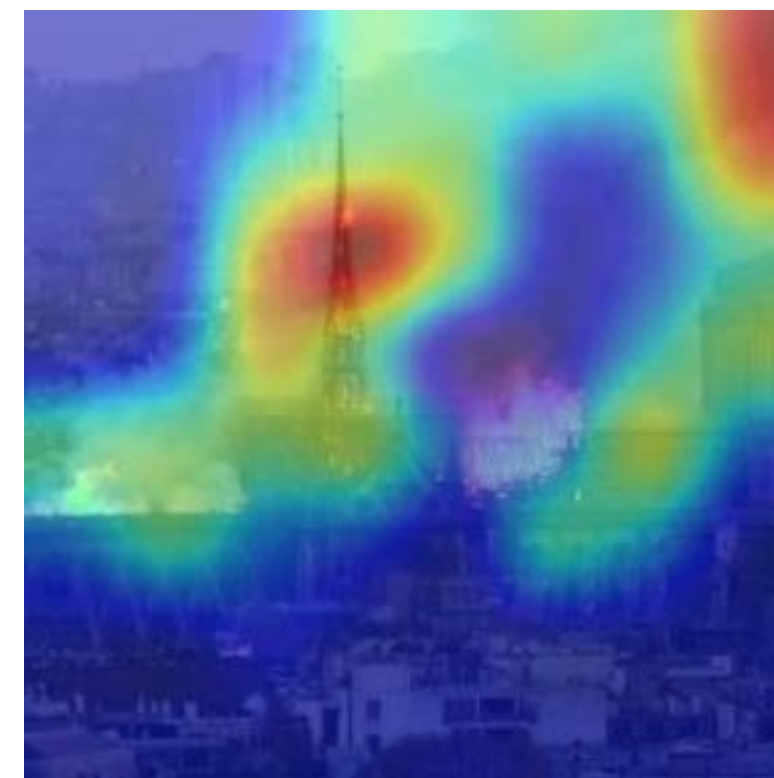
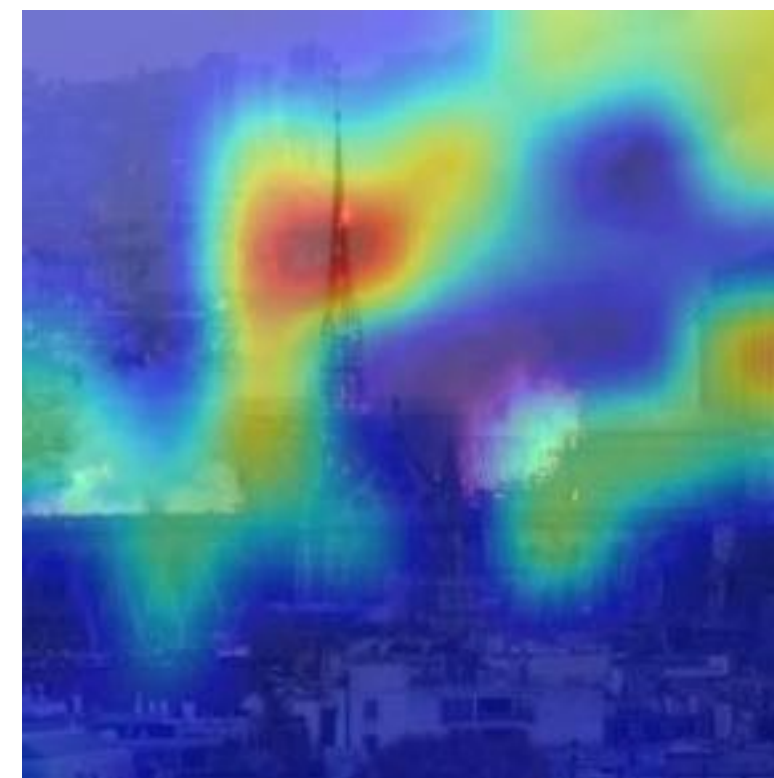
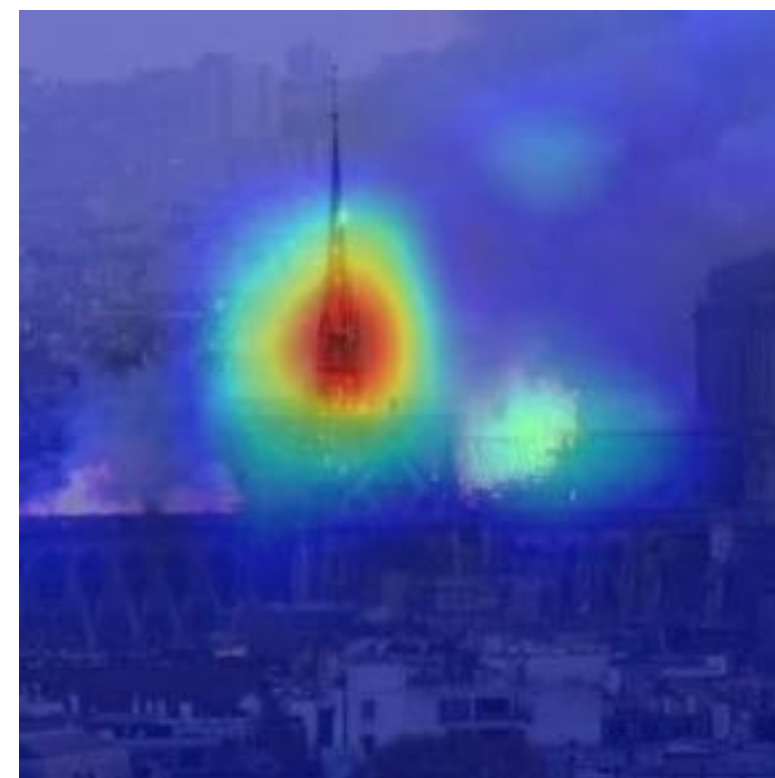
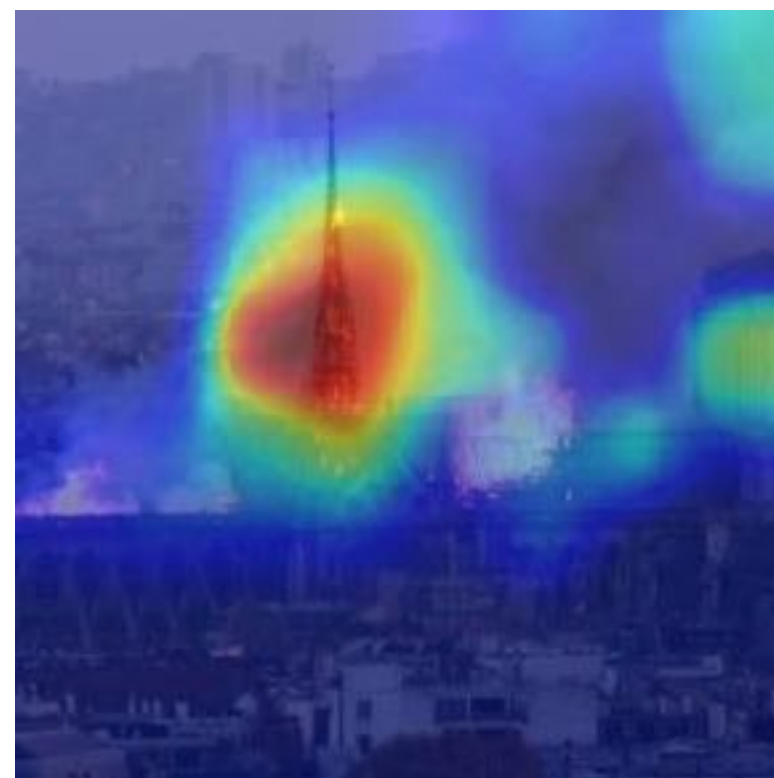
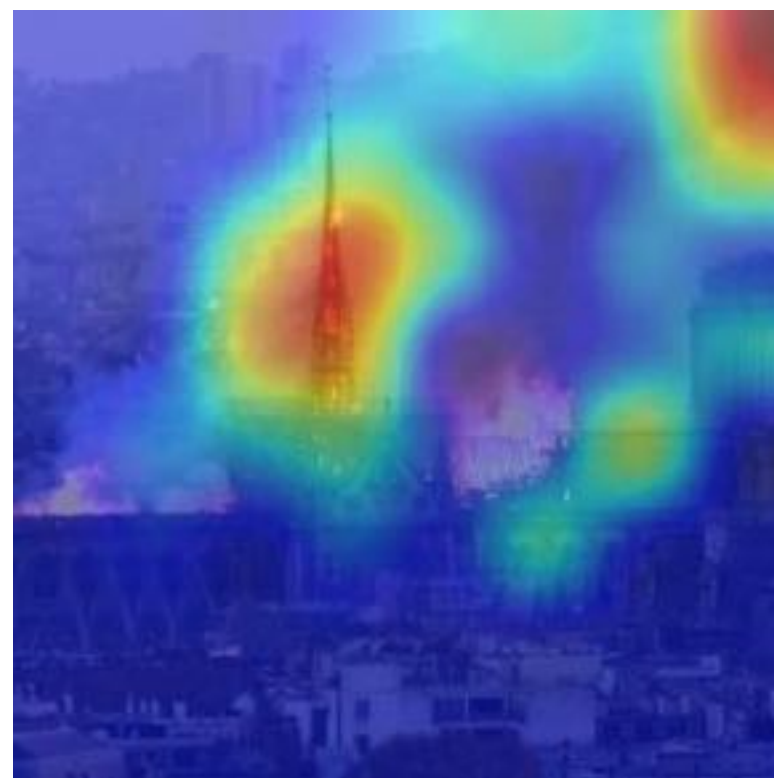
Adversarial Erasing Strategy

Non-Activated Region Occlusion

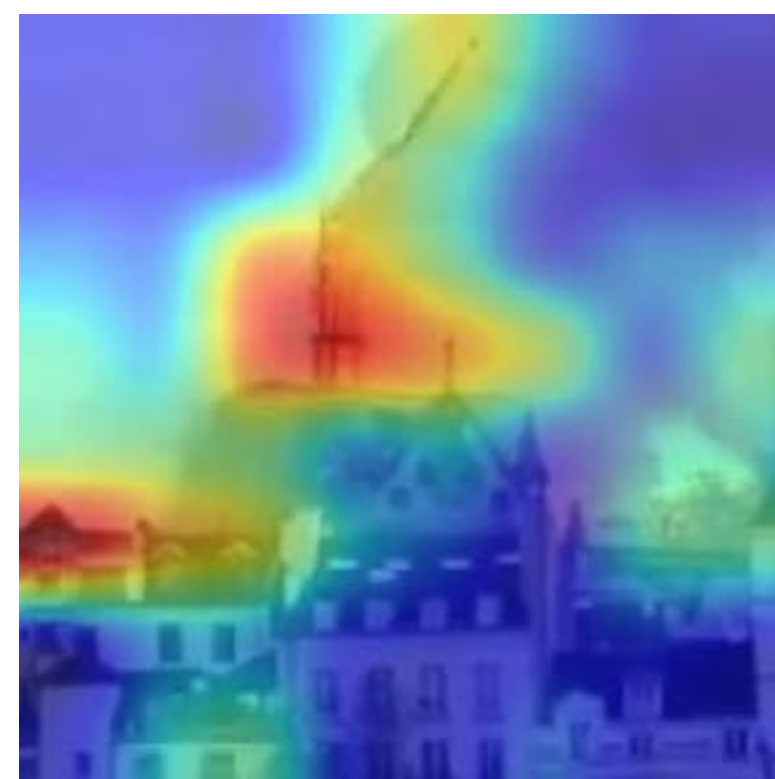
Guided Occlusion Augmentation

Random Occlusion Augmentation

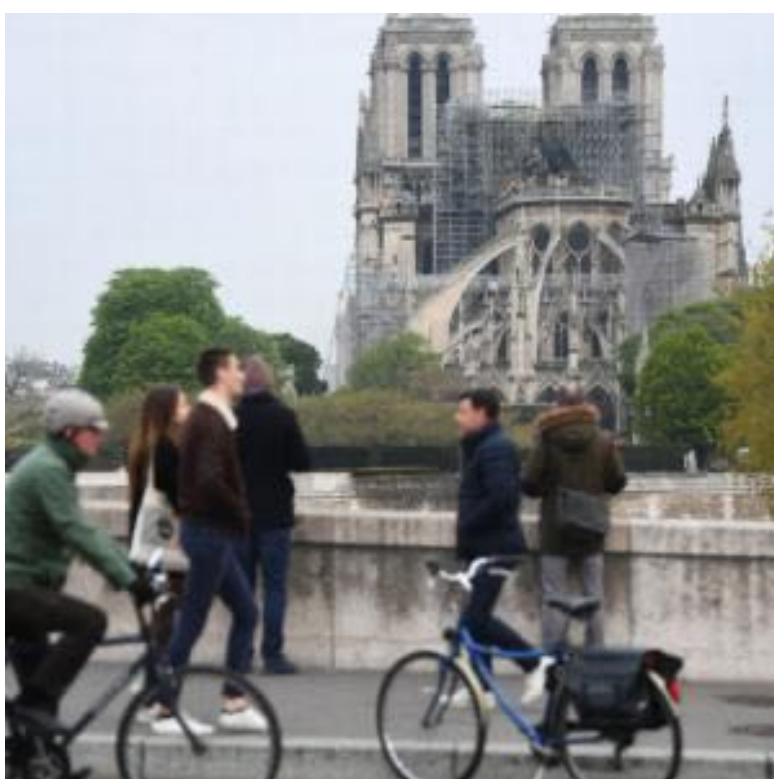
Spire on fire



Spire collapsing



Fire extinguished



CONCLUSIONS

Evaluated several occlusion techniques in the task of chronological sorting;

Classification accuracy improvement over non-occluded models;

Better activation maps, with less false positive activated regions;

Suppressing false positive regions by exploring better fusion approaches;

Dataset of images from the Notre-Dame Cathedral fire event;

Available for download in: <https://bit.ly/NotreDameDataset>



THANK YOU!

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