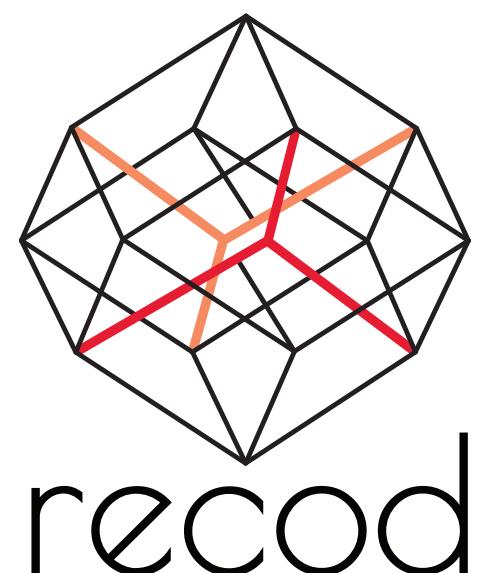




UNICAMP

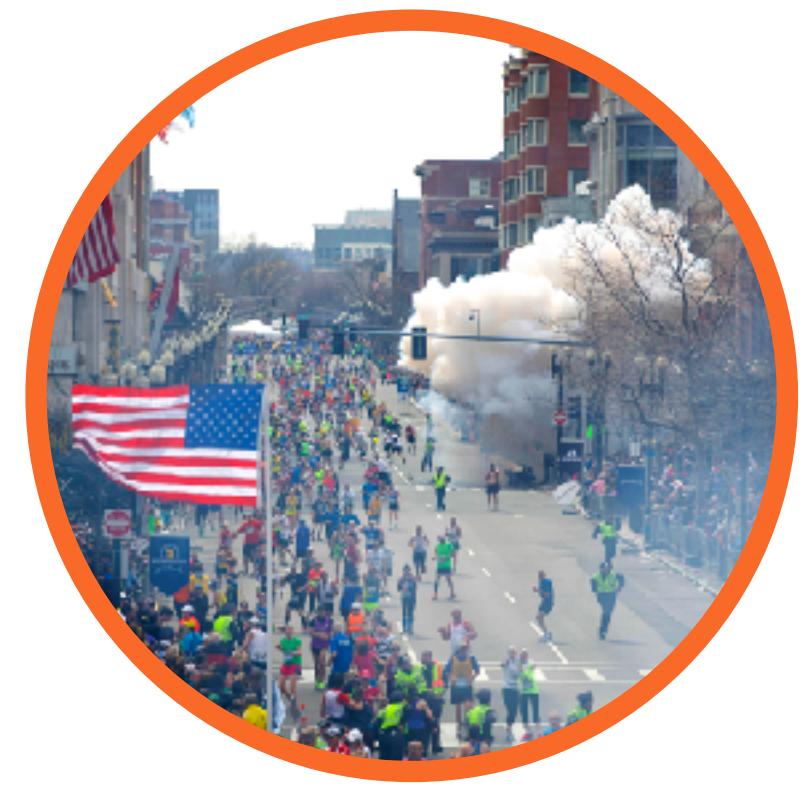


IMPROVING THE CHRONOLOGICAL SORTING OF IMAGES THROUGH OCCLUSION: A STUDY ON THE NOTRE-DAME CATHEDRAL FIRE

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

Institute of Computing - University of Campinas (UNICAMP)





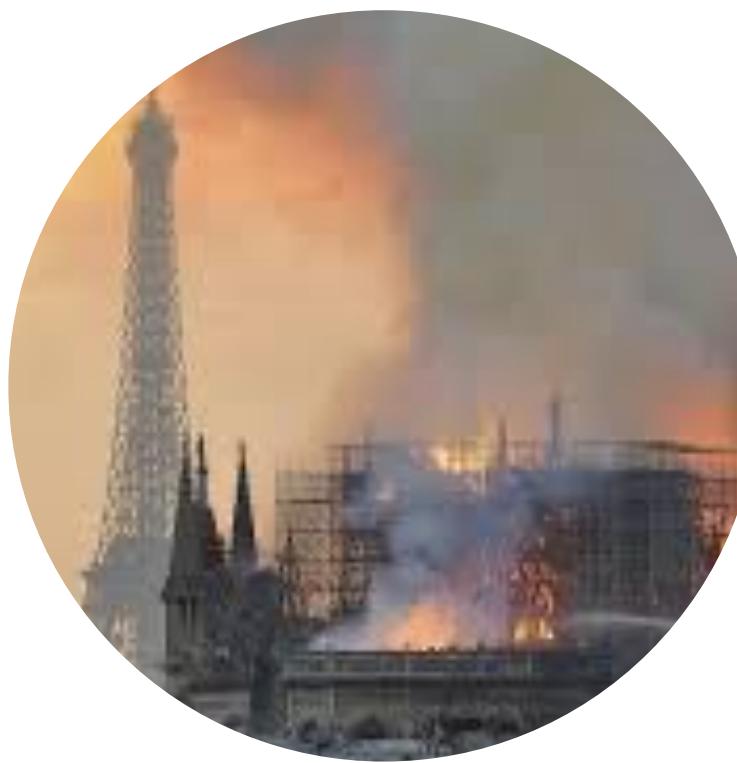
NOTRE-DAME CATHEDRAL FIRE

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

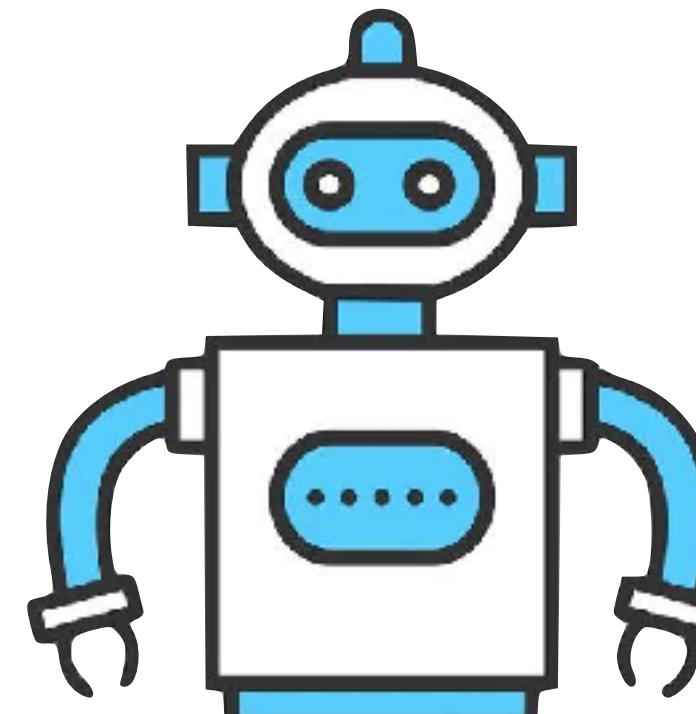
Manual annotation...

ERROR-PRONE



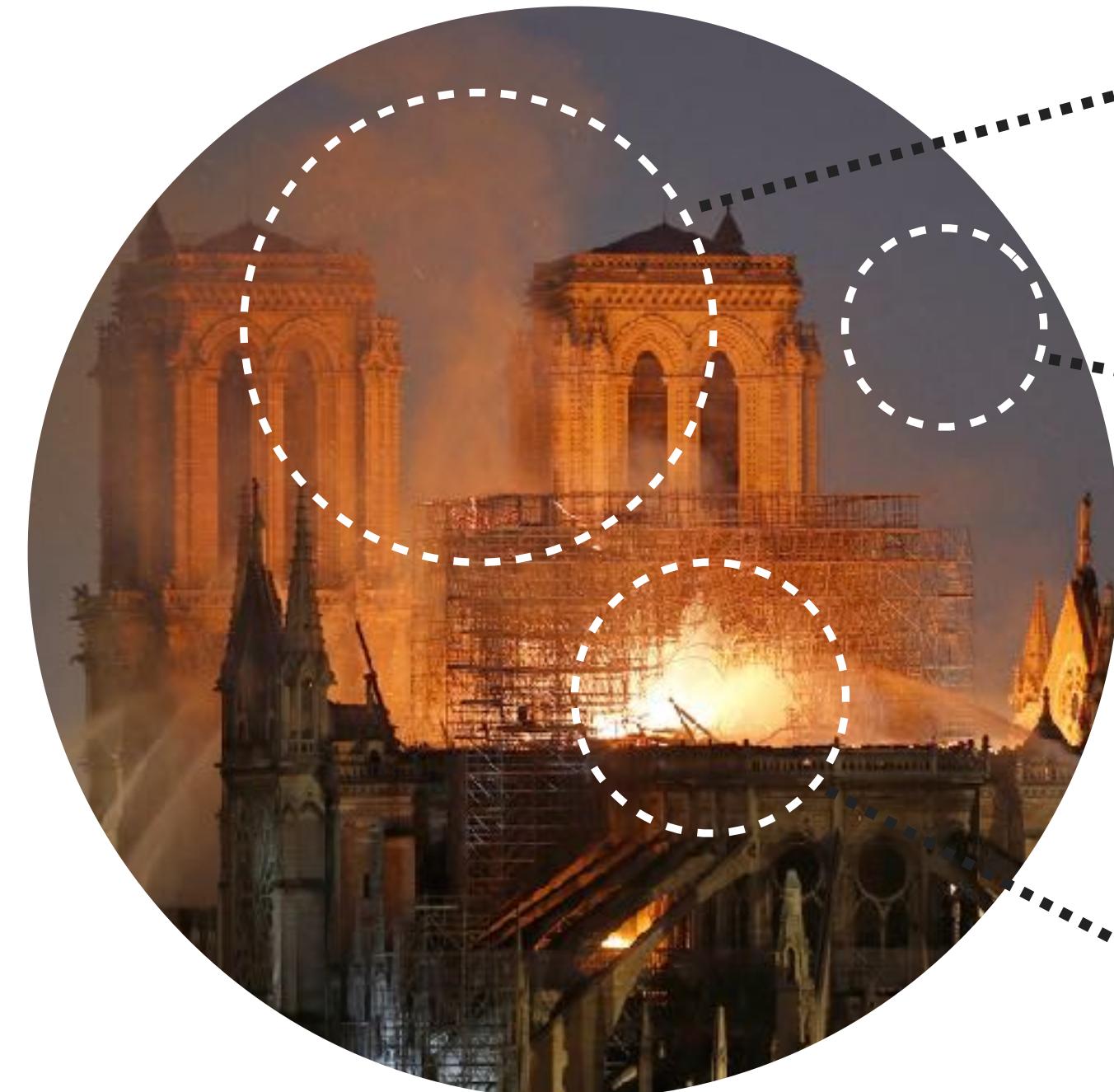
BIAS

TIME-CONSUMING



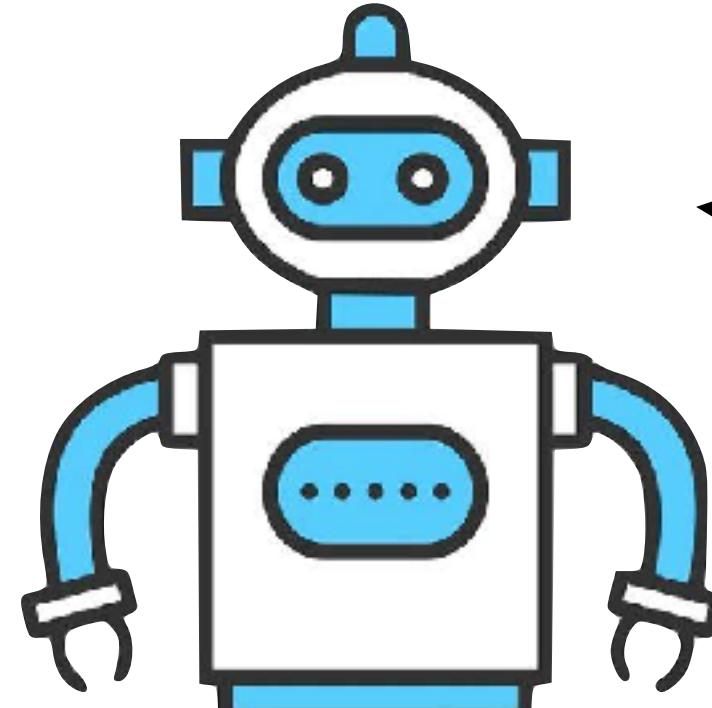
THIS WAS CAPTURED AROUND 6PM, BECAUSE ...

NO SIGN OF
CENTRAL SPIRE



NIGHT SKY

PRESENCE OF FIRE



6PM, THE CENTRAL SPIRE
HAD ALREADY COLLAPSED!

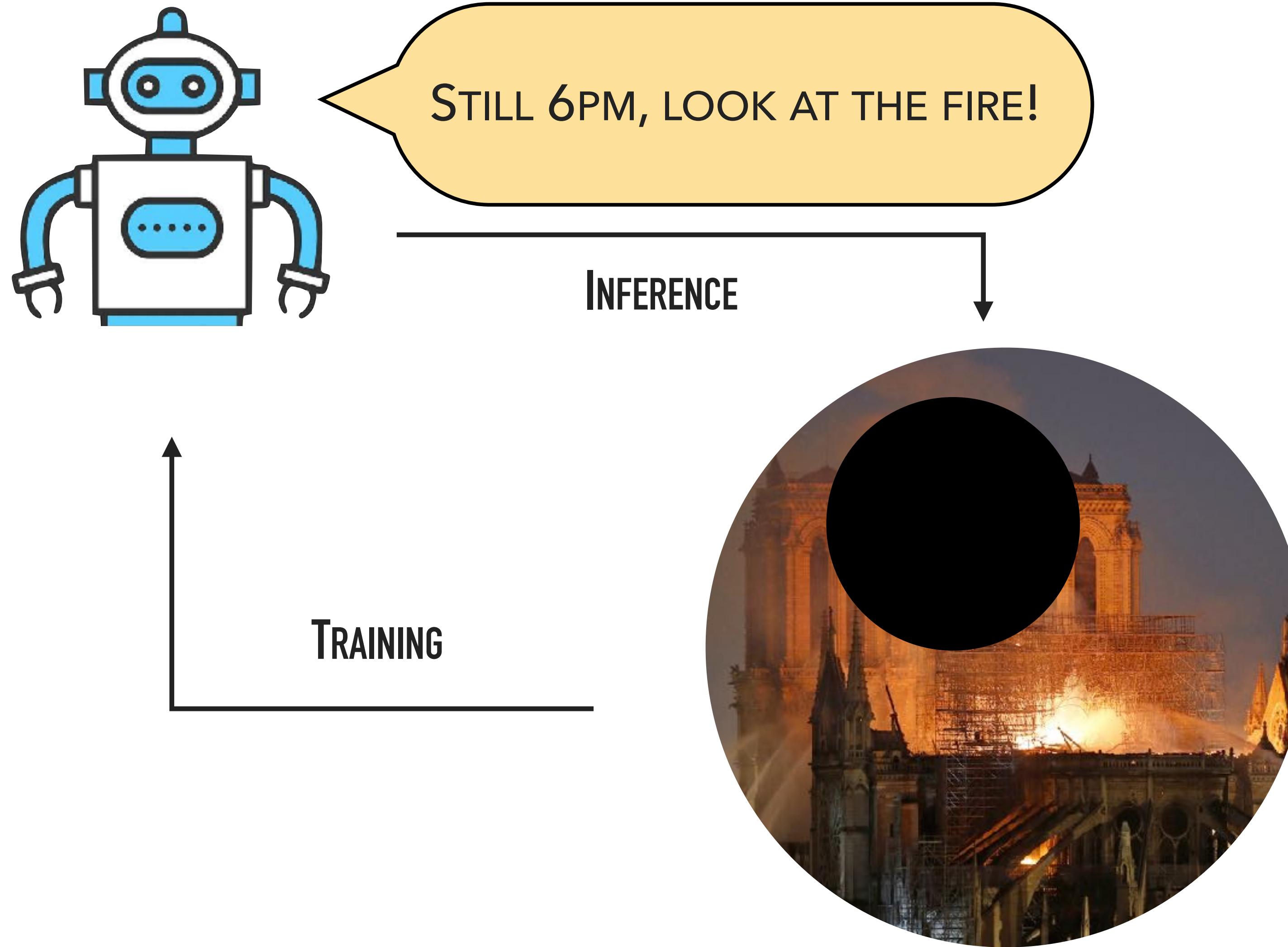
NO SIGN OF
CENTRAL SPIRE



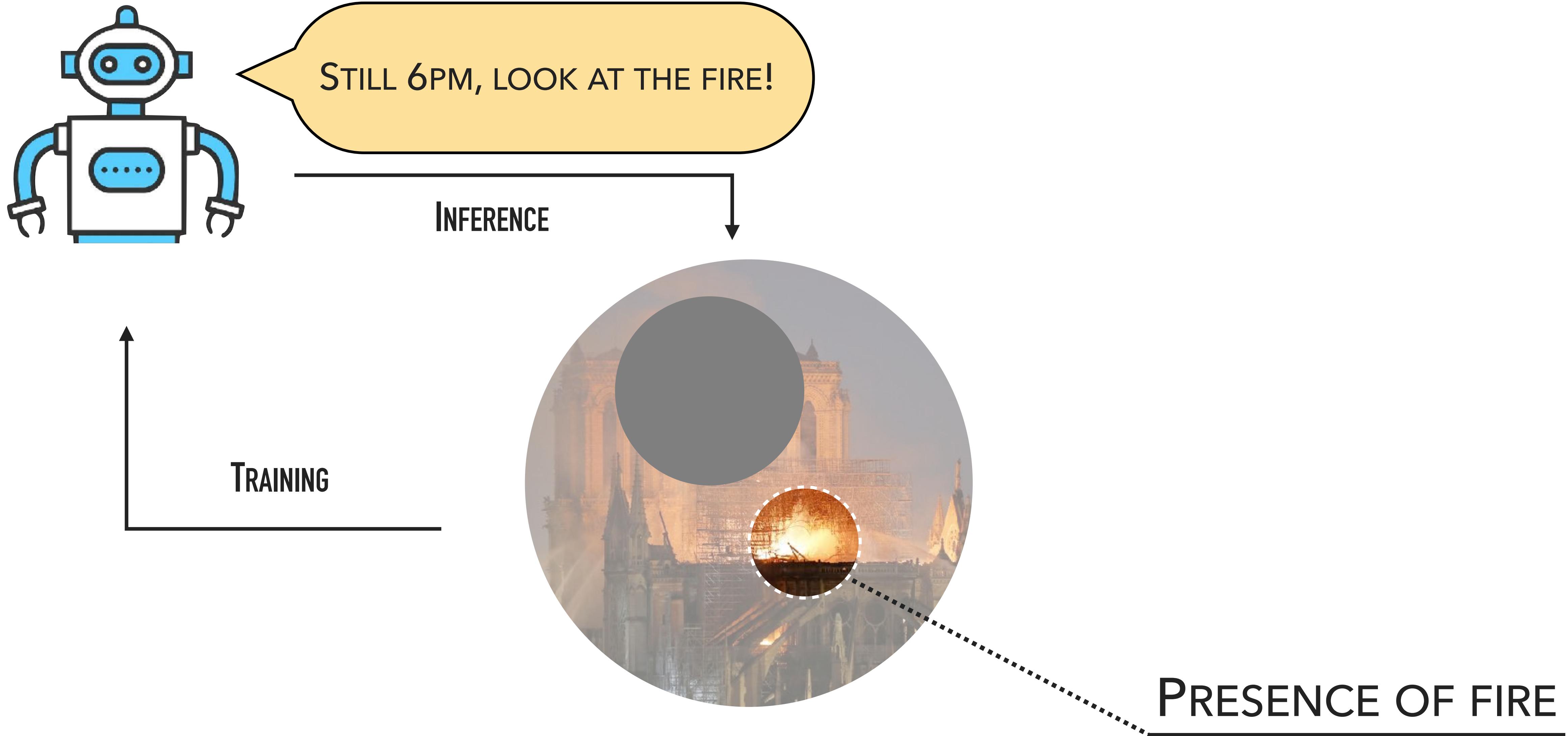
NIGHT SKY

PRESENCE OF FIRE

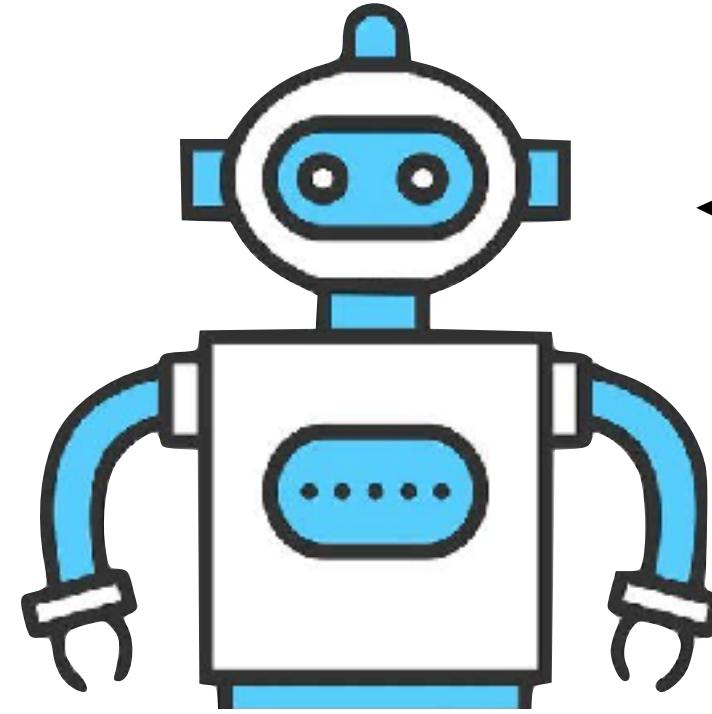
ADVERSARIAL ERASING STRATEGY



ADVERSARIAL ERASING STRATEGY



ADVERSARIAL ERASING STRATEGY



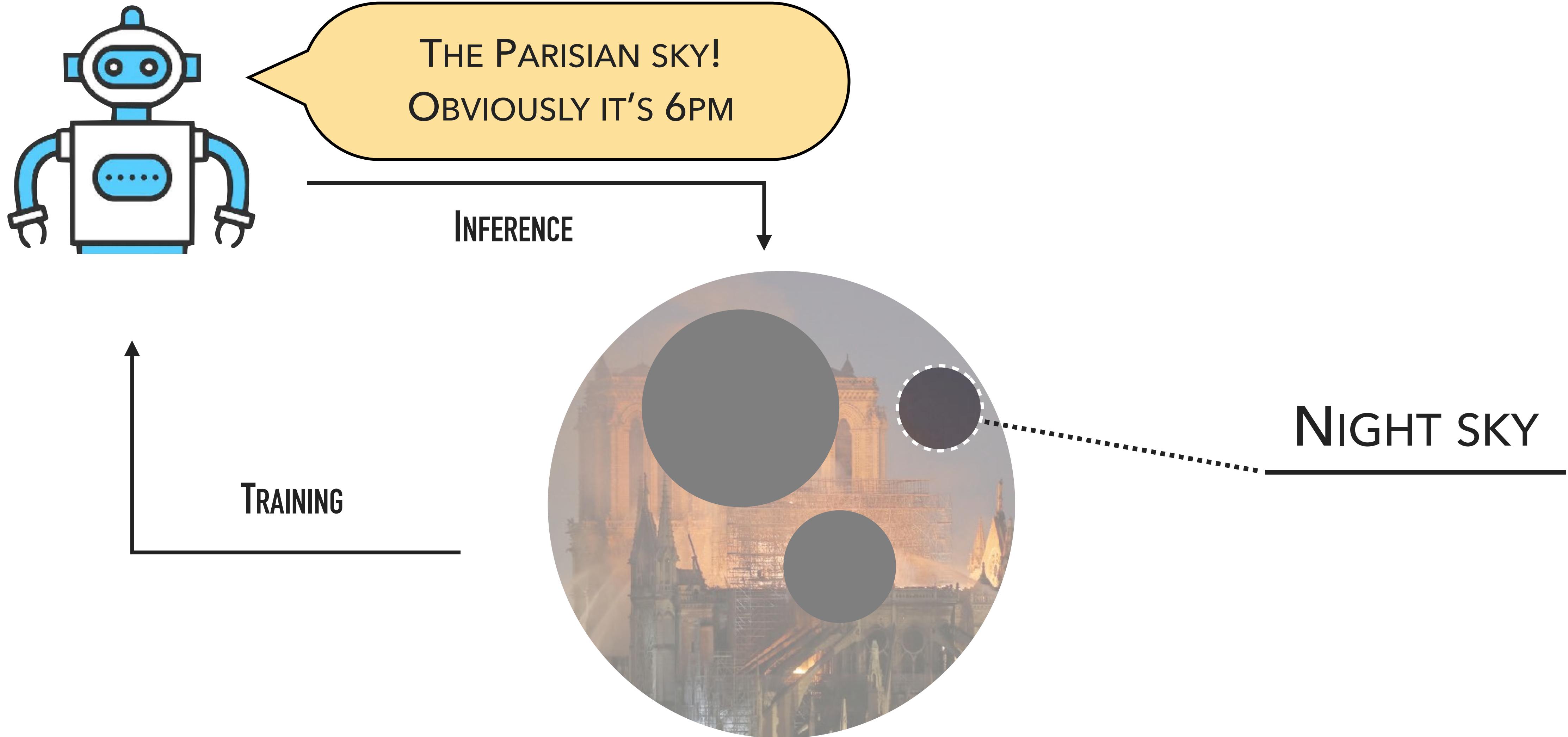
THE PARISIAN SKY!
OBVIOUSLY IT'S 6PM

INFERENCE

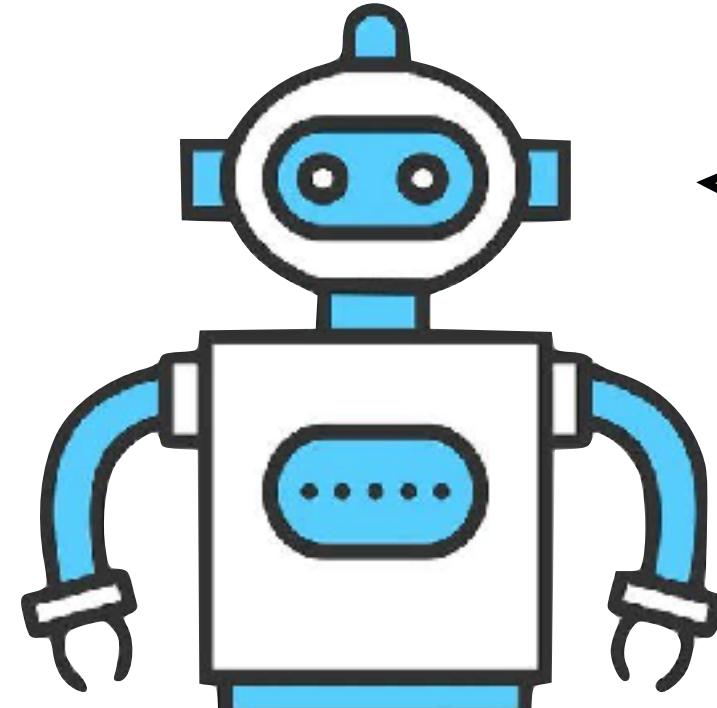
TRAINING



ADVERSARIAL ERASING STRATEGY

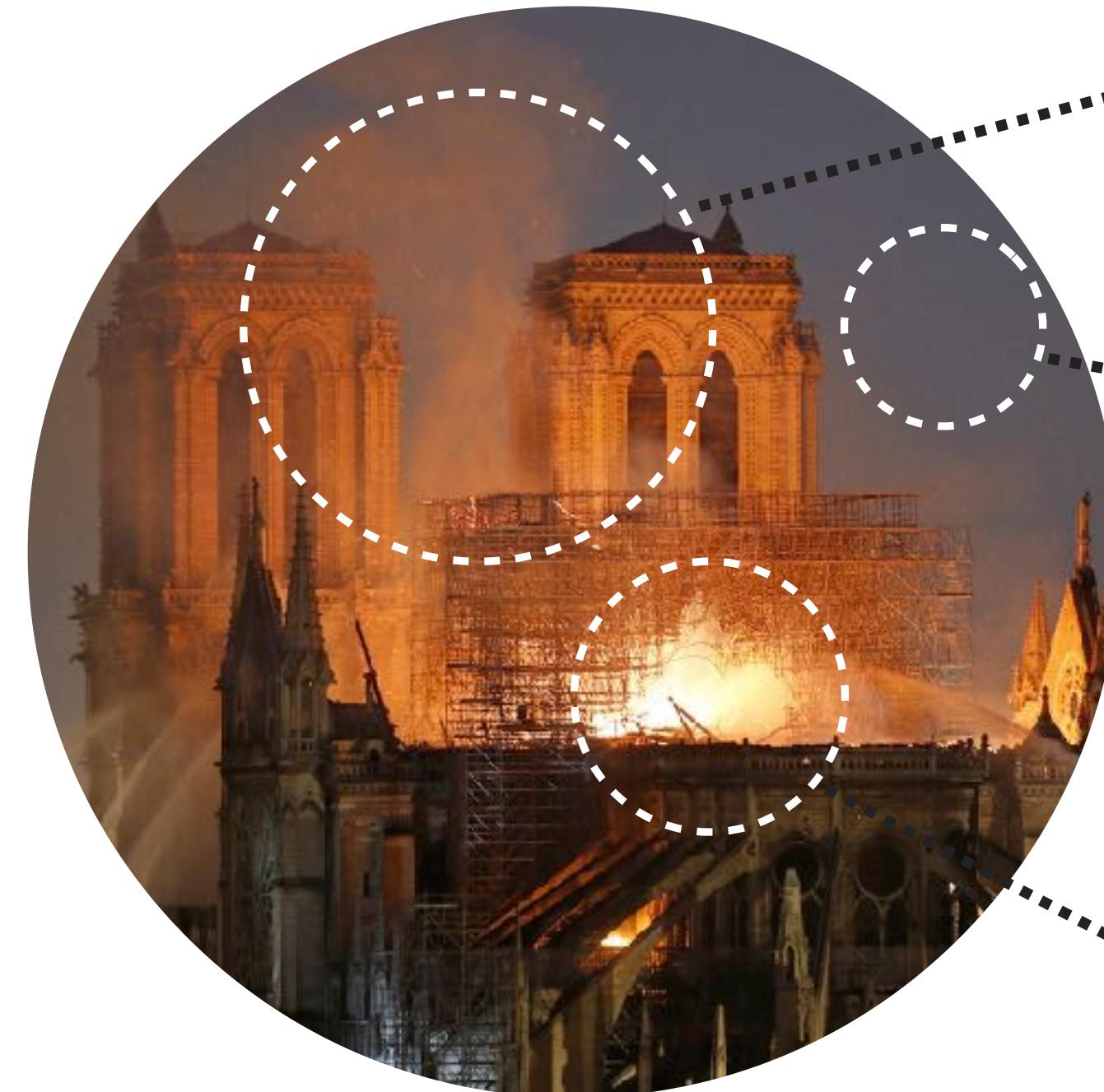


ADVERSARIAL ERASING STRATEGY



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

INTRODUCTION

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

INTRODUCTION

MAIN CONTRIBUTIONS

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



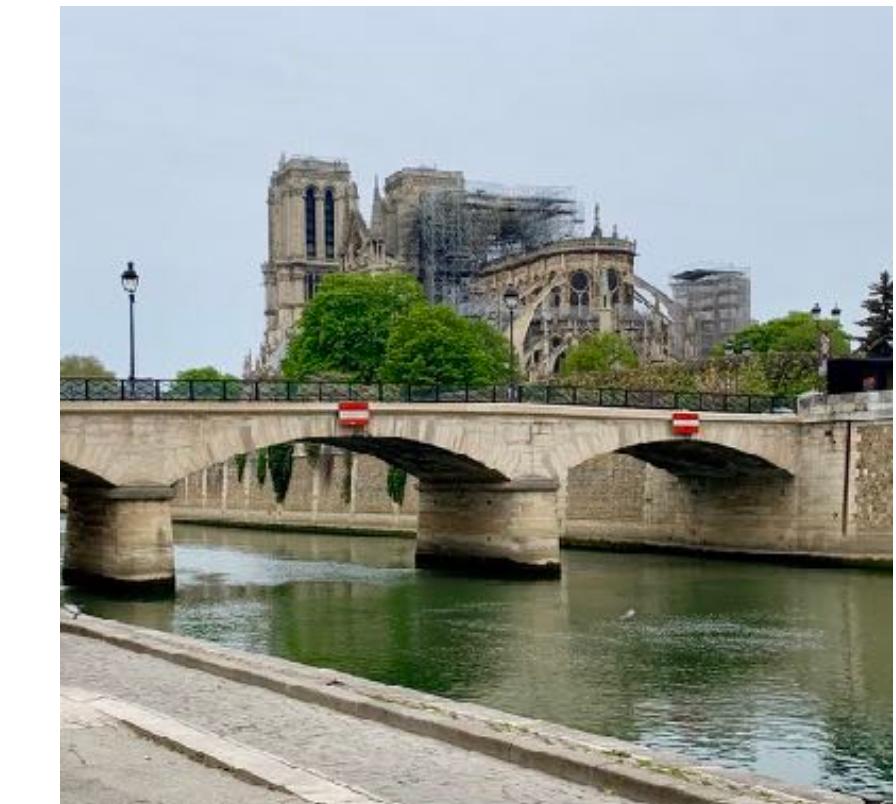
Spire on Fire



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

NOTRE-DAME CATHEDRAL FIRE - DATASET

23,000+ IMAGES



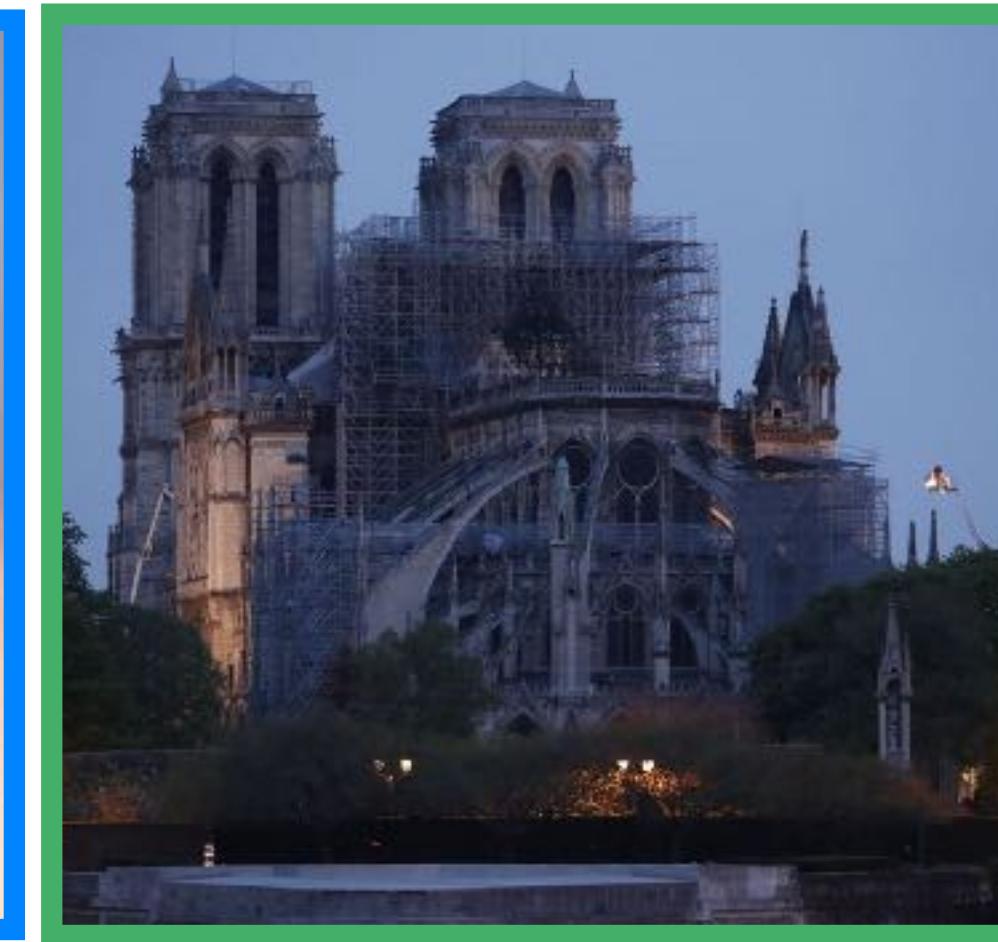
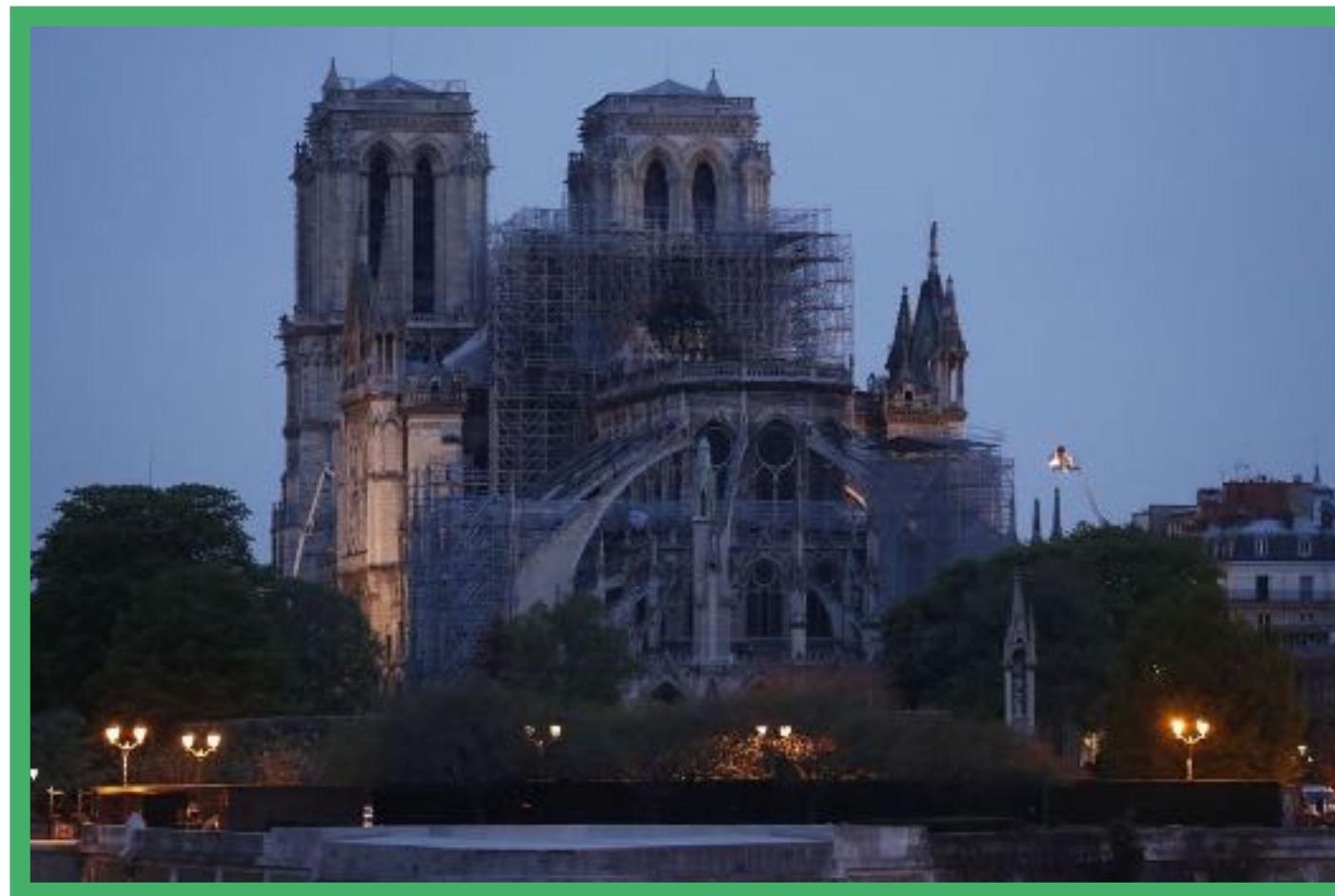
NOTRE-DAME CATHEDRAL FIRE - DATASET

5,200+ IMAGES



NOTRE-DAME CATHEDRAL FIRE - DATASET

5,200+ IMAGES

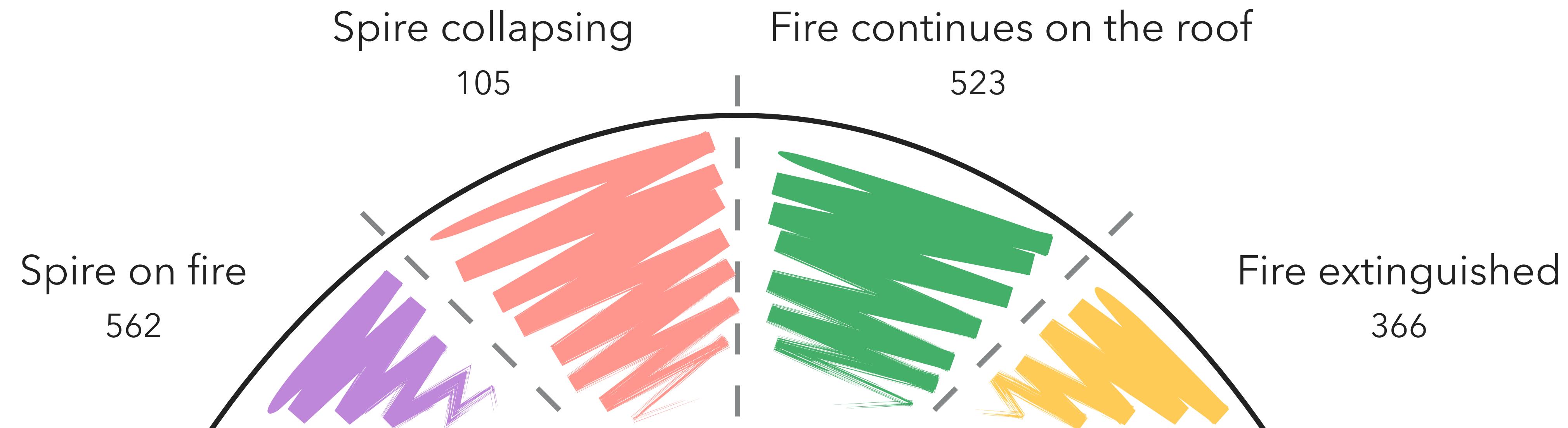


NOTRE-DAME CATHEDRAL FIRE - DATASET

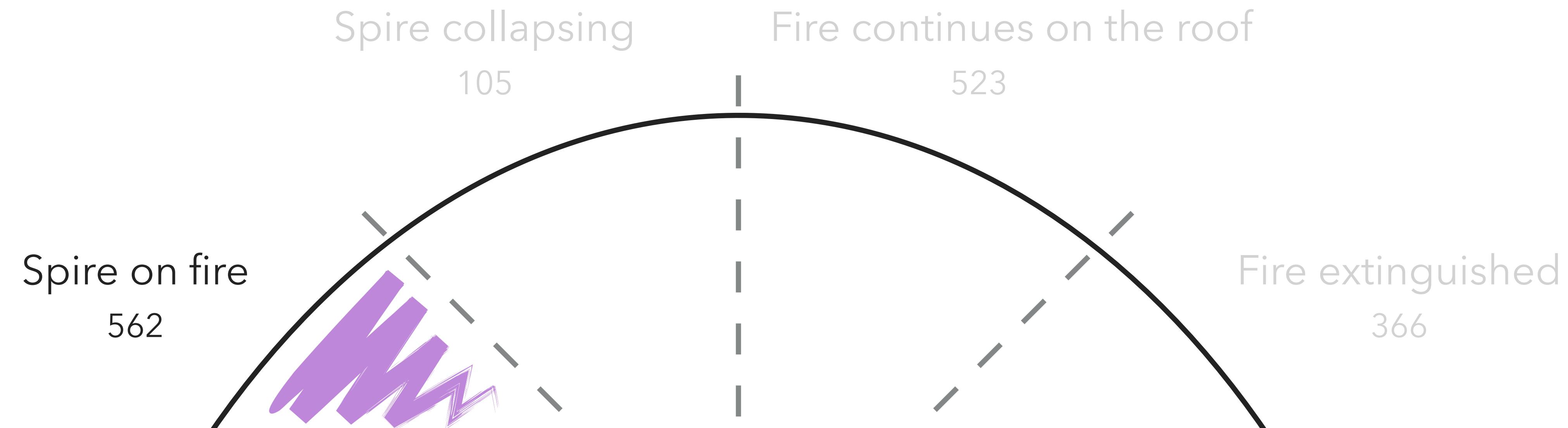
1,600+ IMAGES



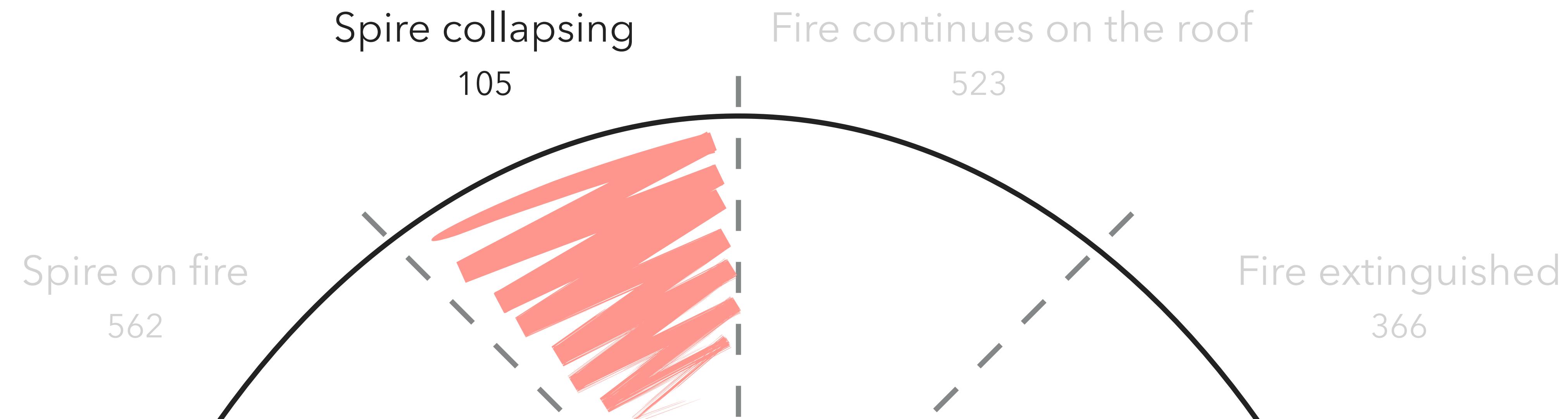
MOMENTS IN TIME



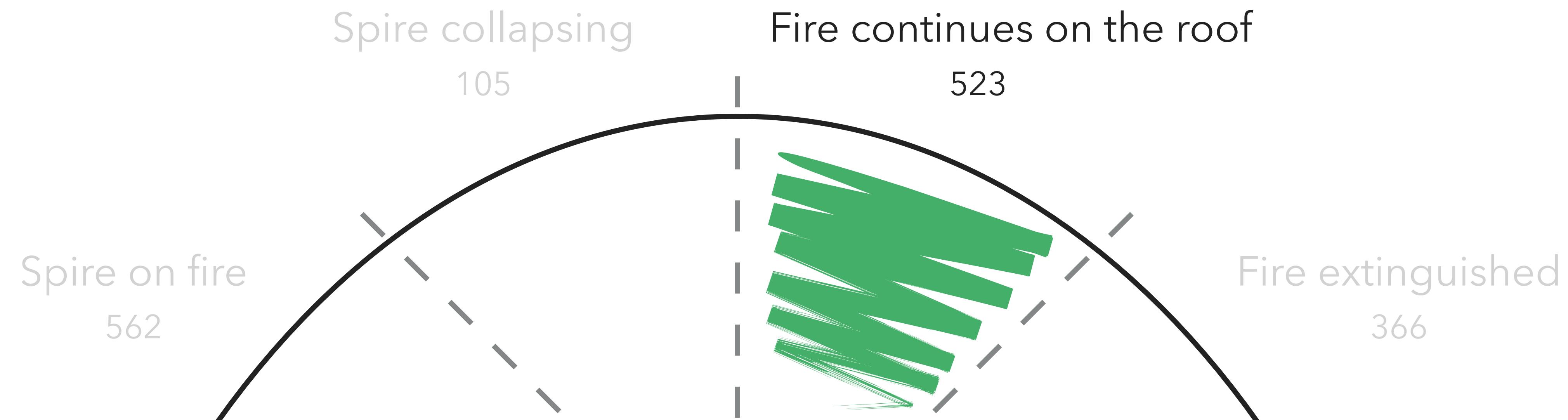
NOTRE-DAME CATHEDRAL FIRE - DATASET



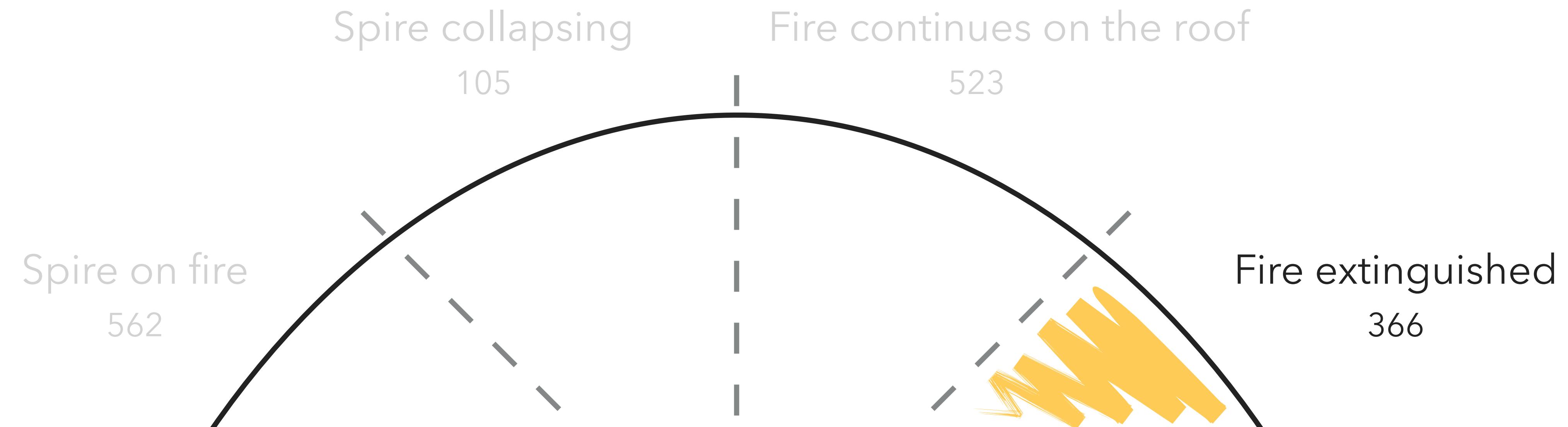
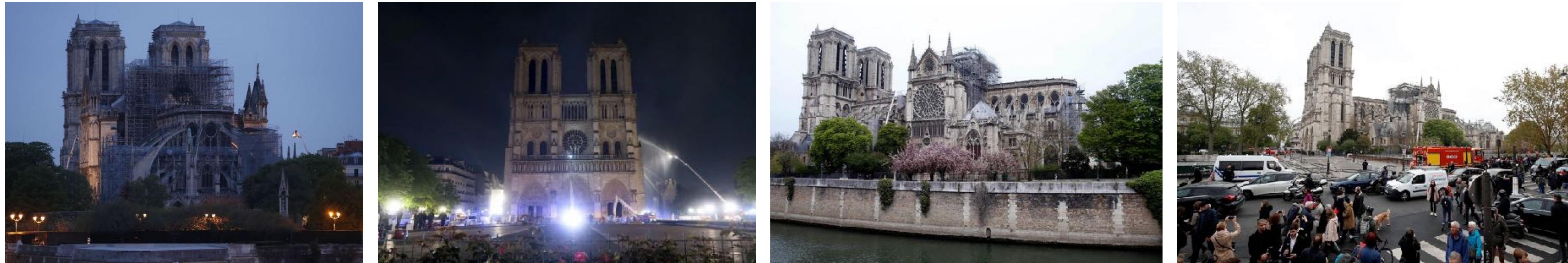
NOTRE-DAME CATHEDRAL FIRE - DATASET



NOTRE-DAME CATHEDRAL FIRE - DATASET



NOTRE-DAME CATHEDRAL FIRE - DATASET

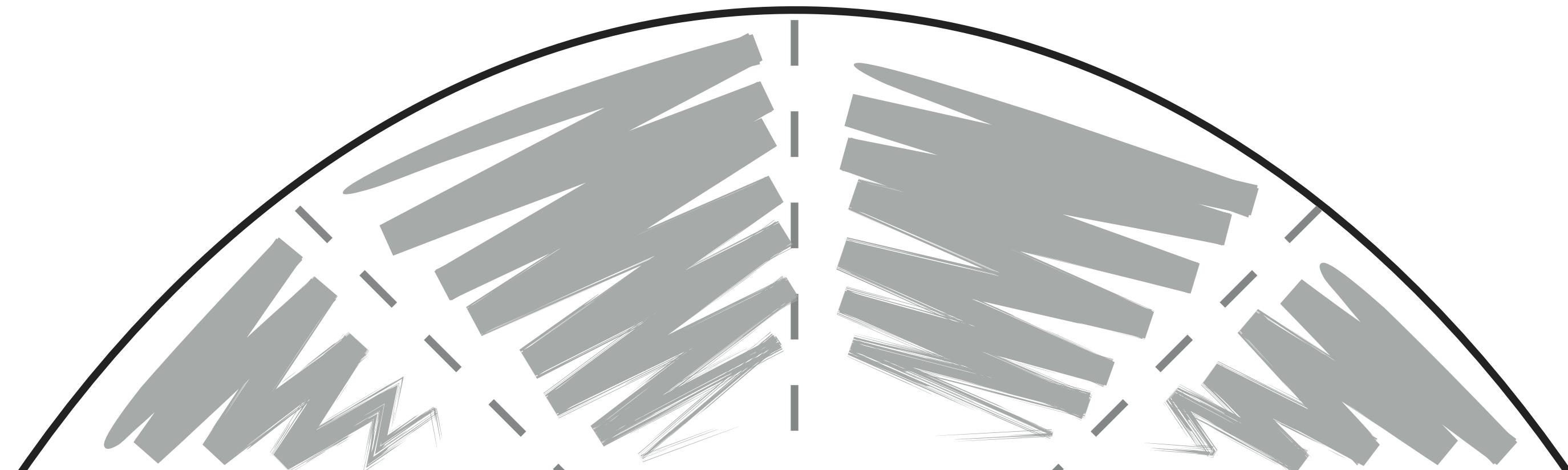


NOTRE-DAME CATHEDRAL FIRE - DATASET



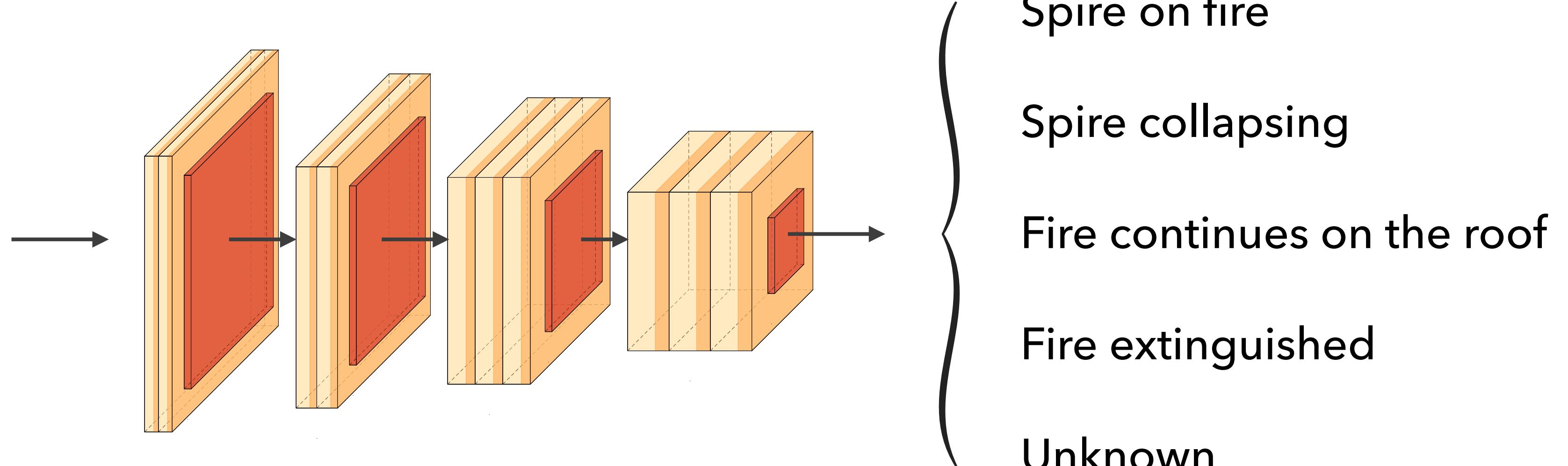
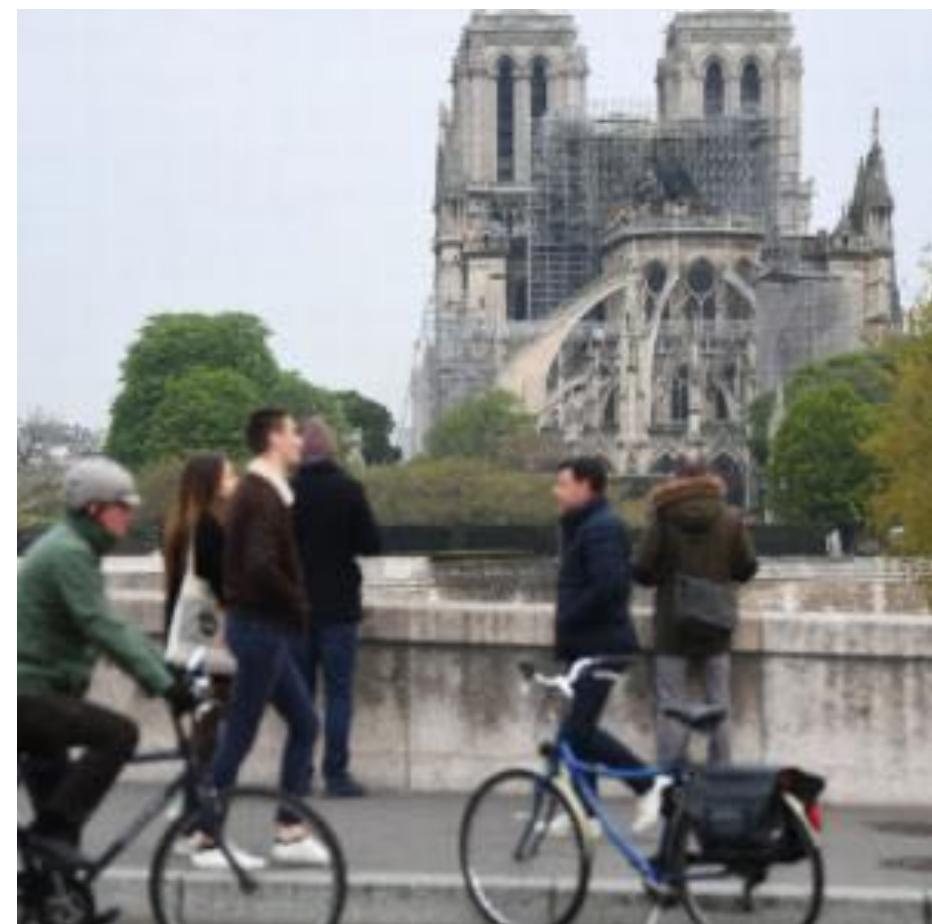
Unknown

101



PROPOSED METHOD

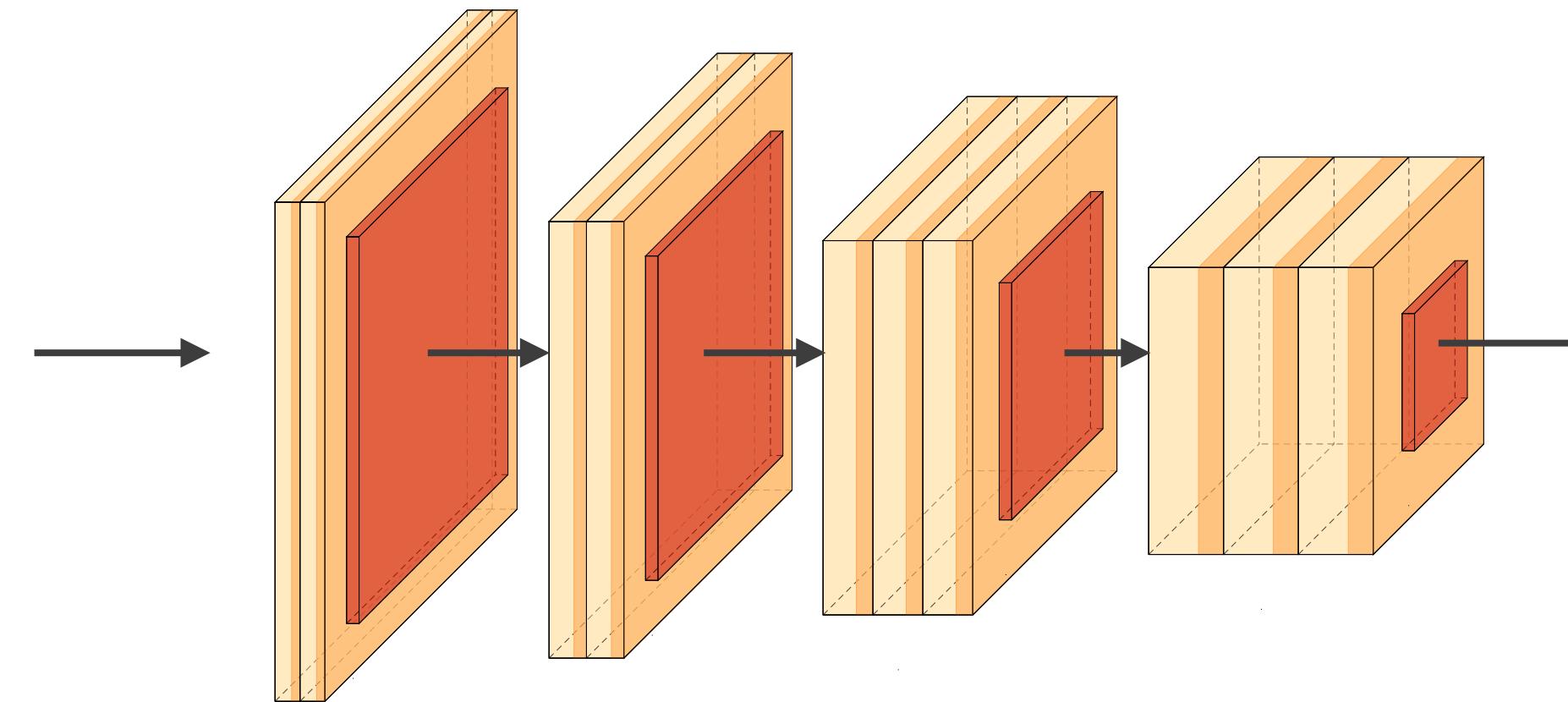
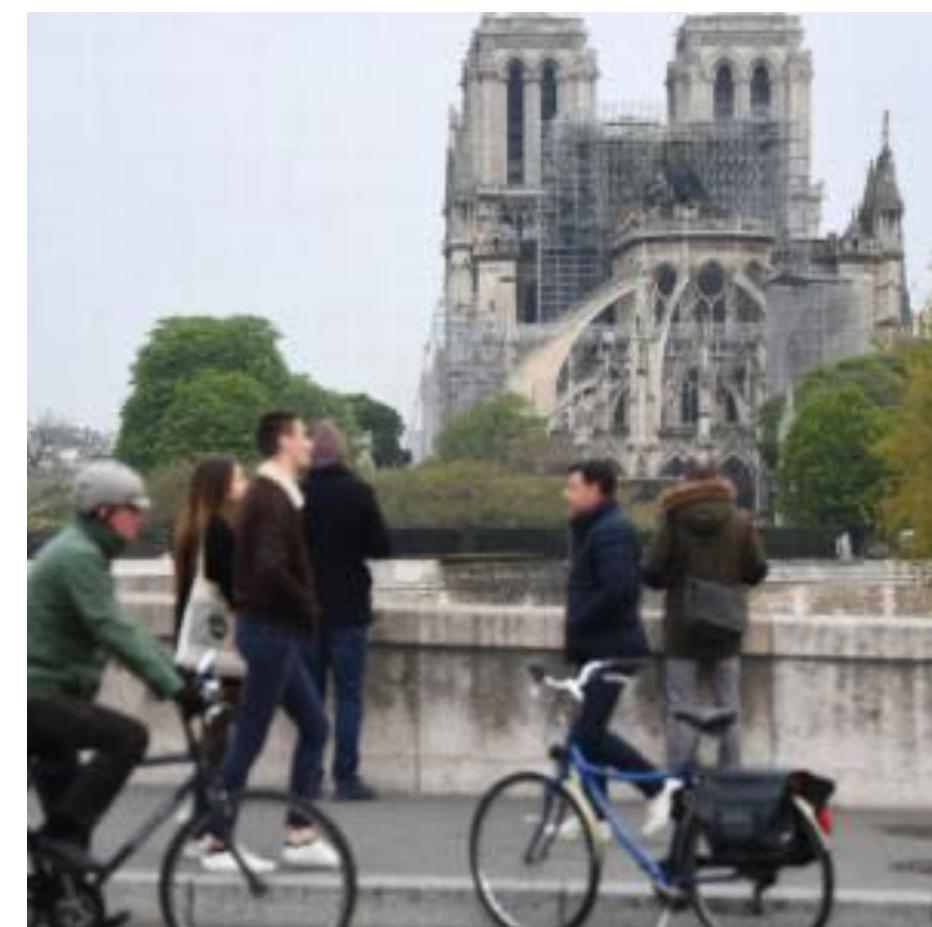
MULTI-CLASS CLASSIFICATION



CONVOLUTIONAL NEURAL NETWORK

PROPOSED METHOD

MULTI-CLASS CLASSIFICATION



Fire extinguished



CLASS ACTIVATION MAP

Ramprasaath R Selvaraju, et al. *Grad-cam Visual explanations from deep networks via gradient-based explanations*. ICCV 2017

Aditya Chattpadhyay, et al. *Grad-cam++: Generalized gradient-based visual explanations for deep convolutional net*. WACV 2018

ACTIVATION MAPS



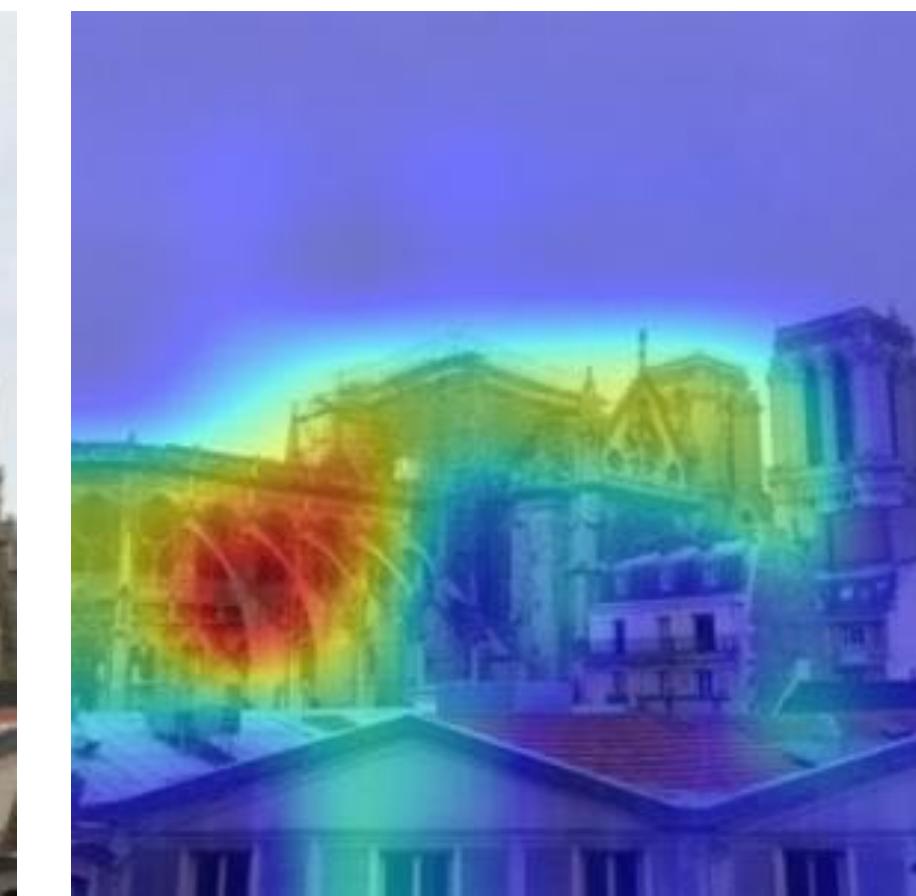
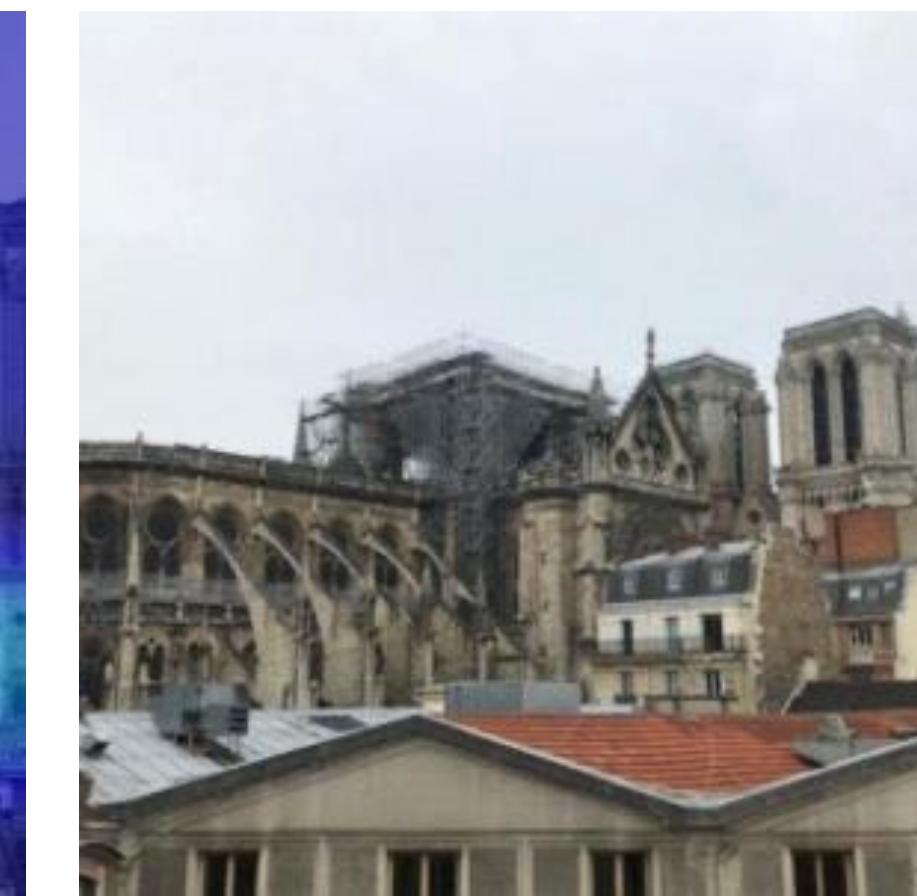
Spire on fire



Spire collapsing



Fire continues on the roof

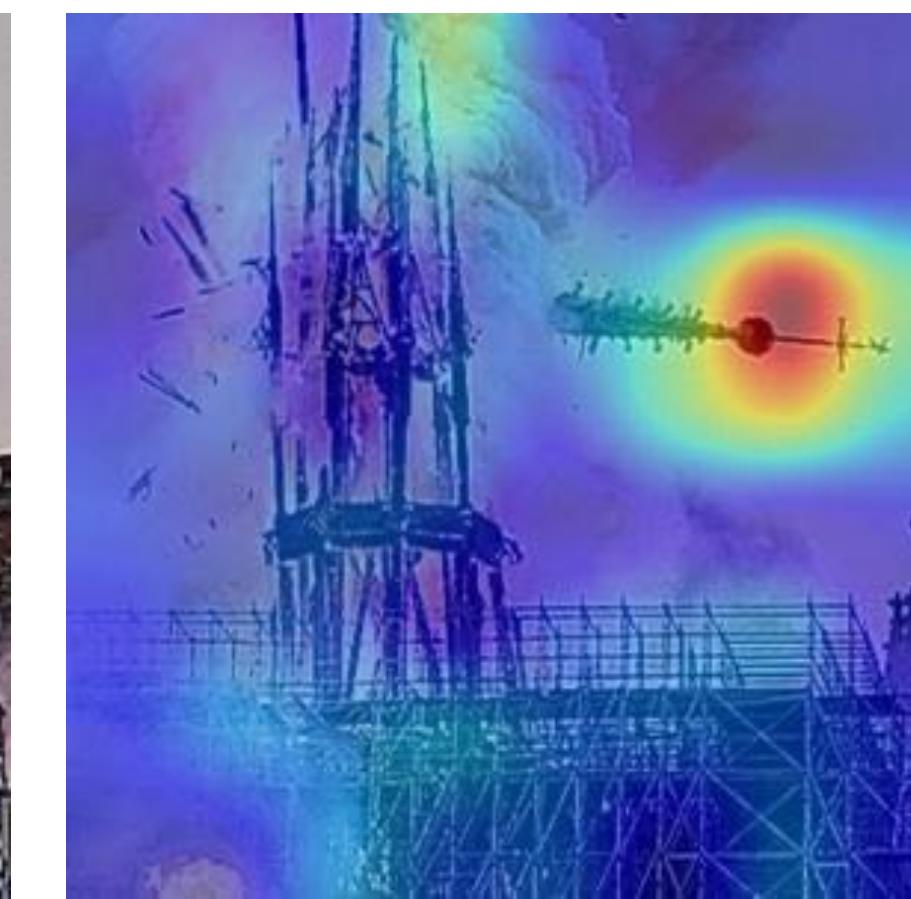
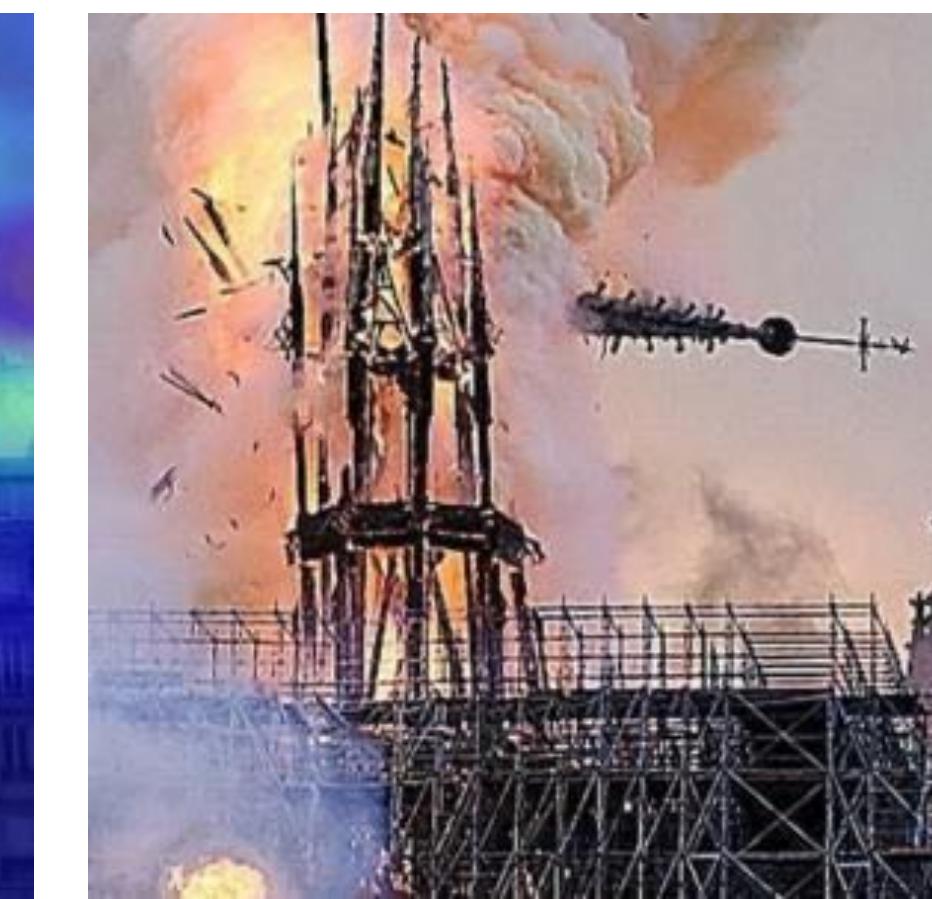


Fire extinguished

ACTIVATION MAPS



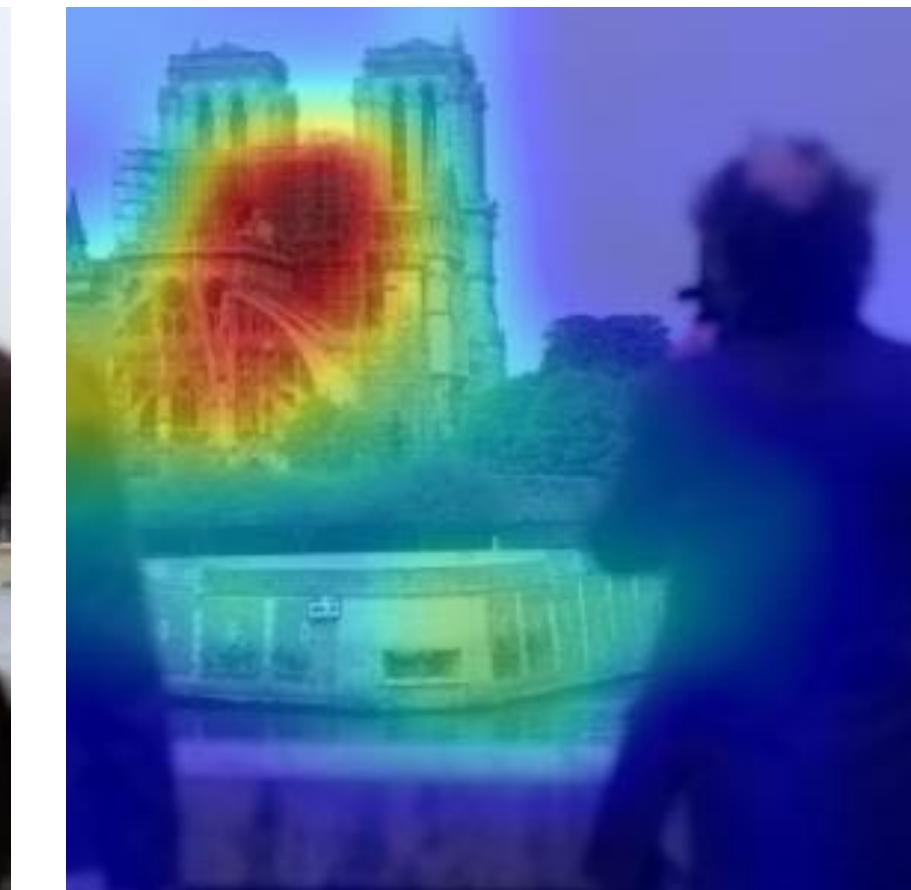
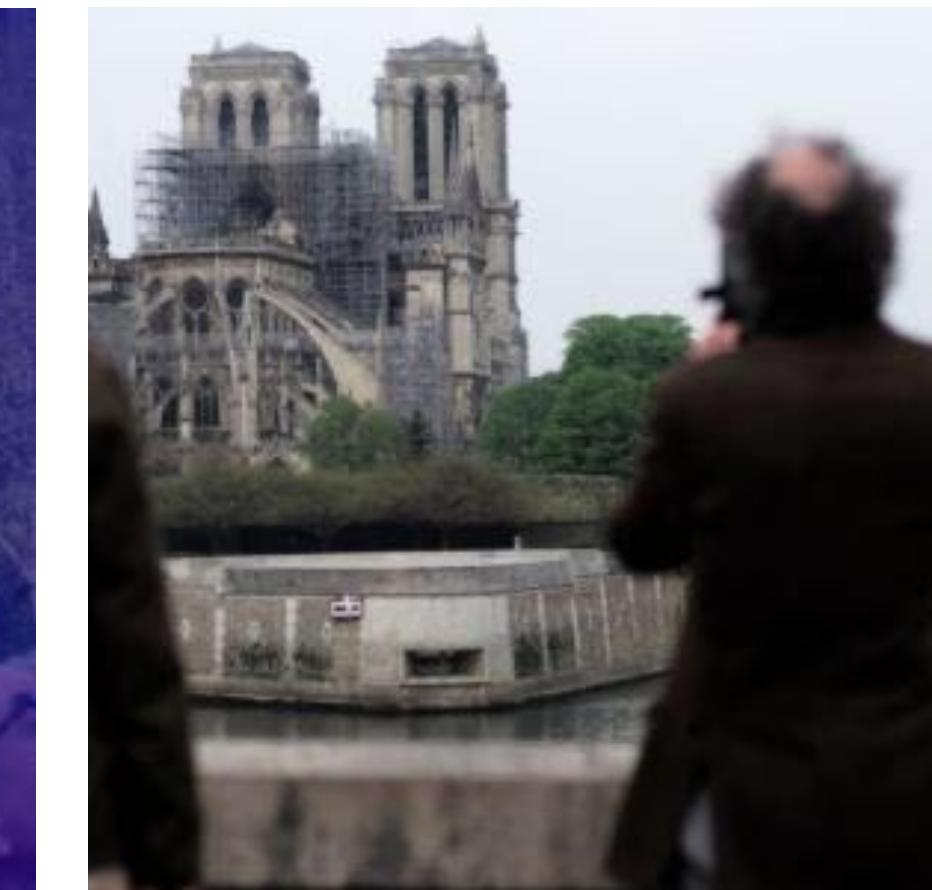
Spire on fire



Spire collapsing

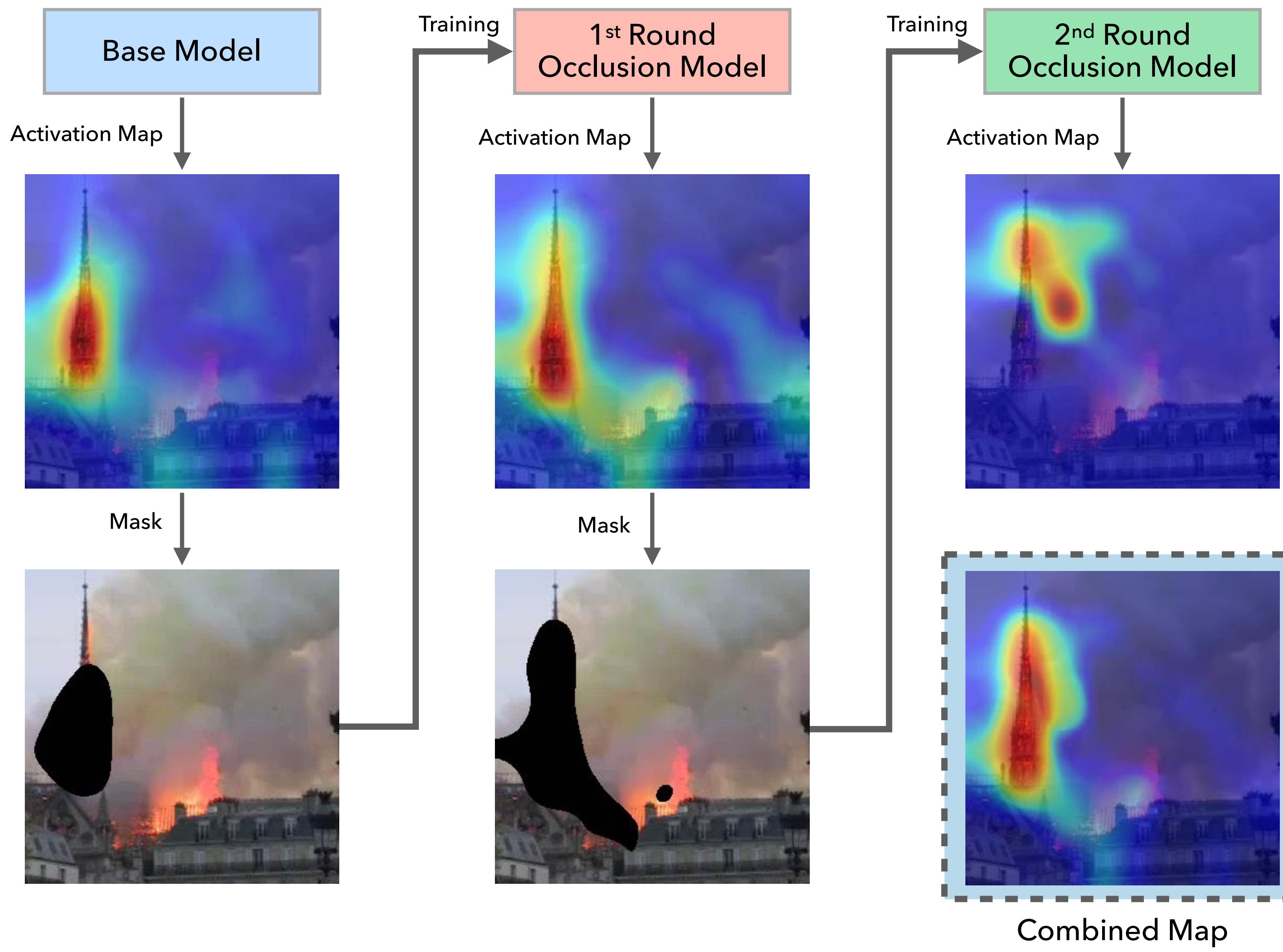


Fire continues on the roof

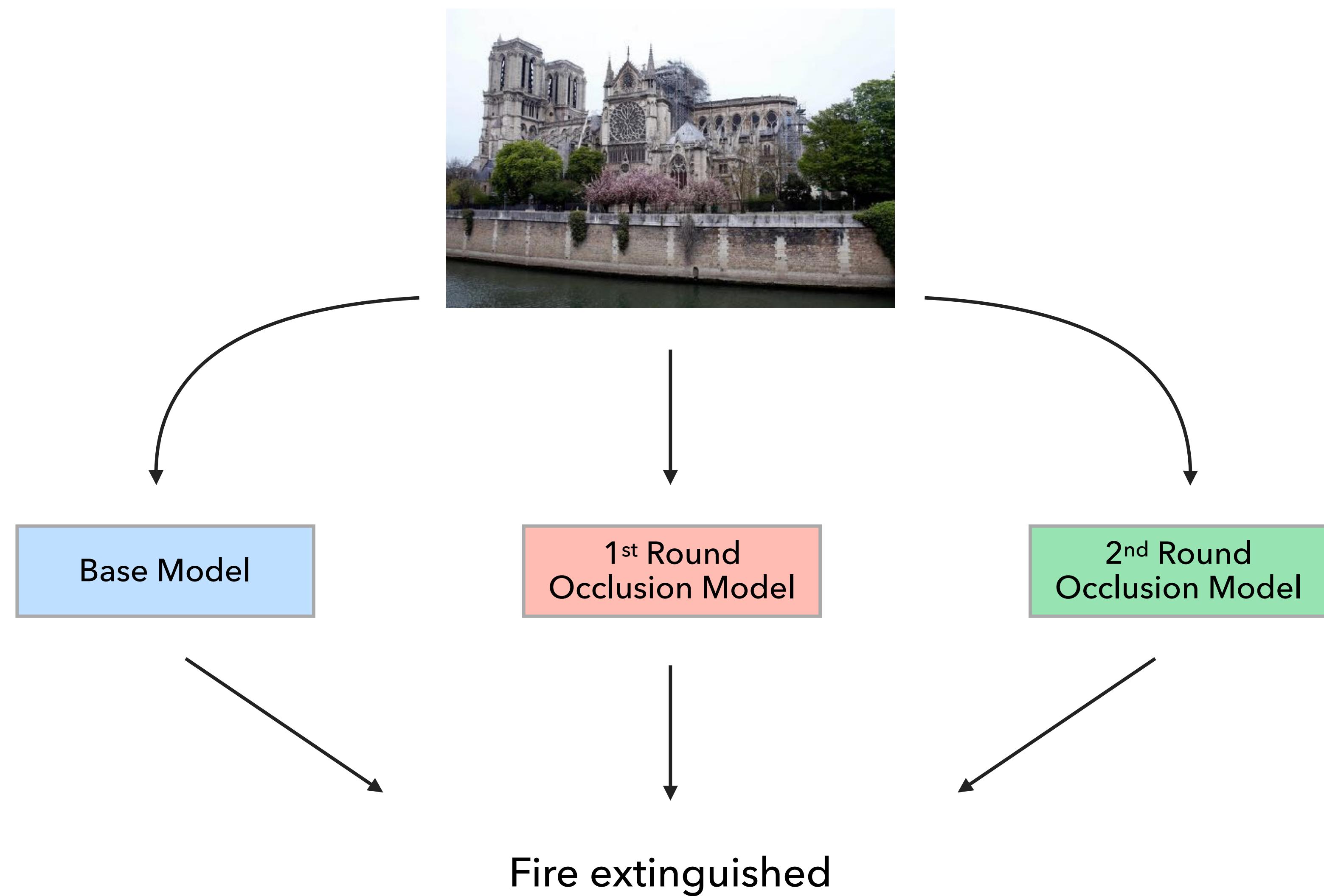


Fire extinguished

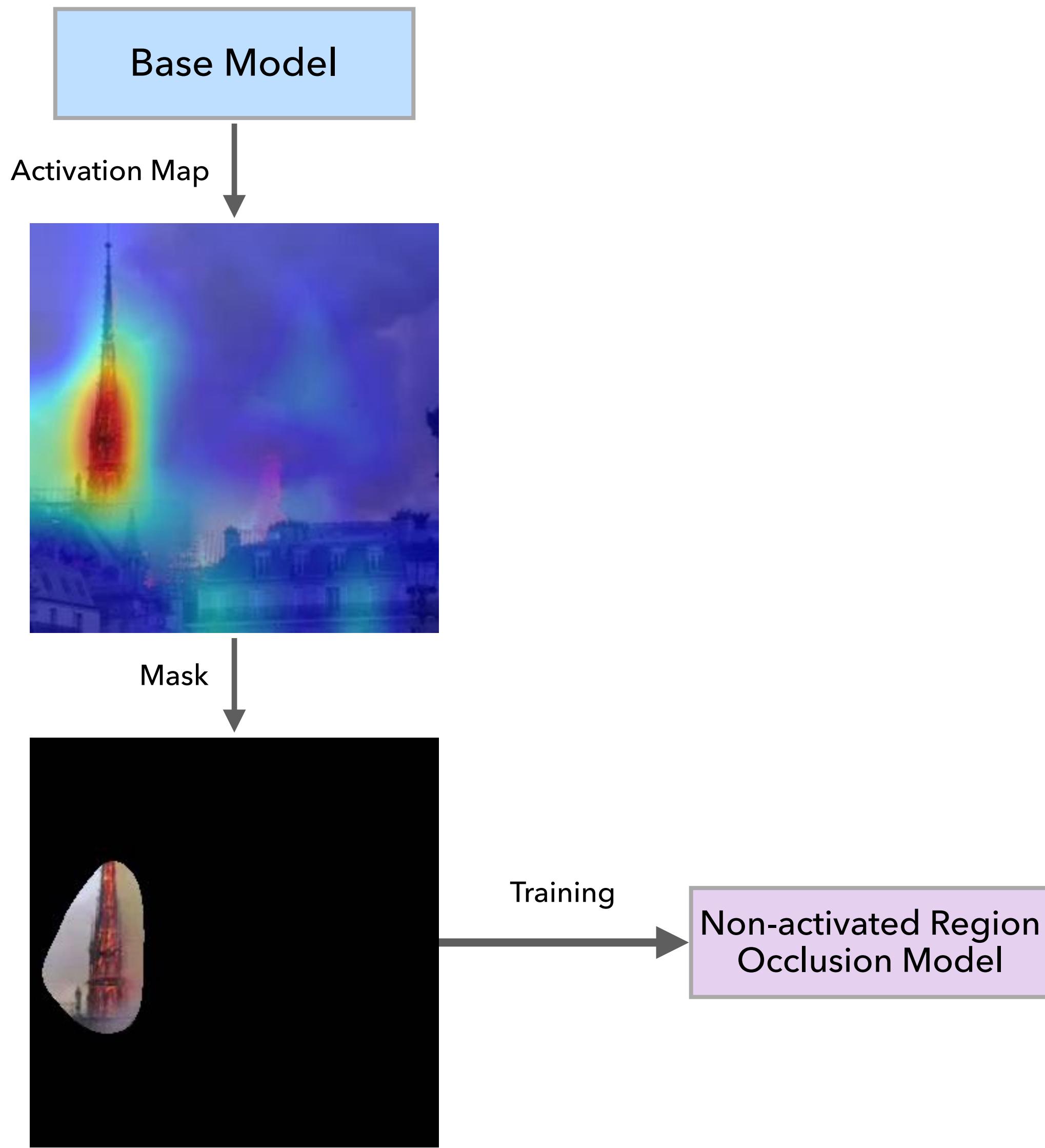
ADVERSARIAL ERASING STRATEGY



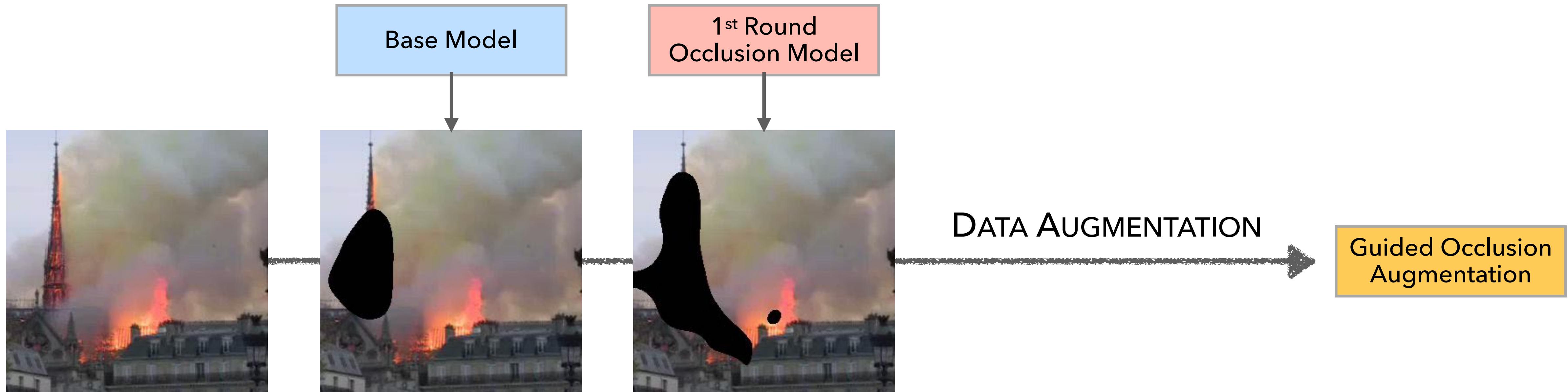
ADVERSARIAL ERASING STRATEGY



NON-ACTIVATED REGION OCCLUSION



OCCLUSION AS DATA AUGMENTATION

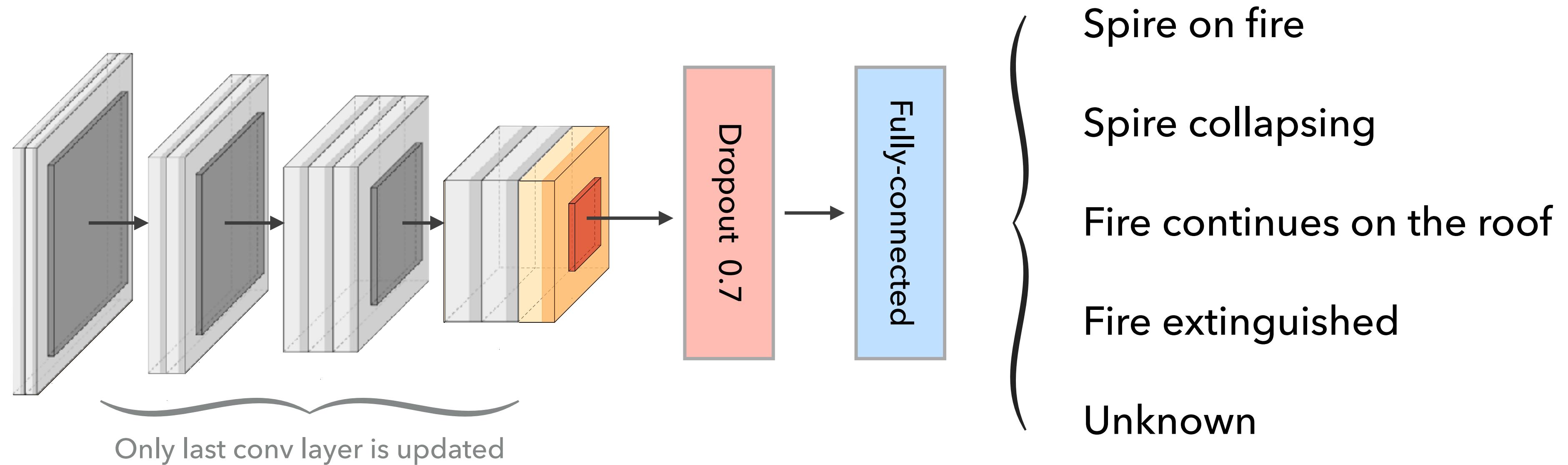


COVERING 10% TO 45% OF IMAGE IN RANDOM POSITION



TRAINING DETAILS

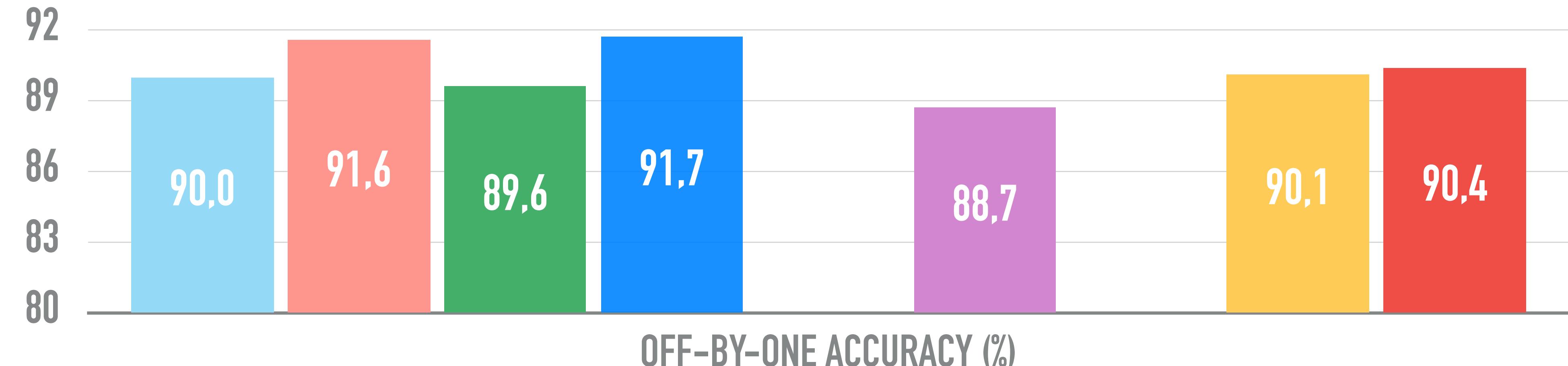
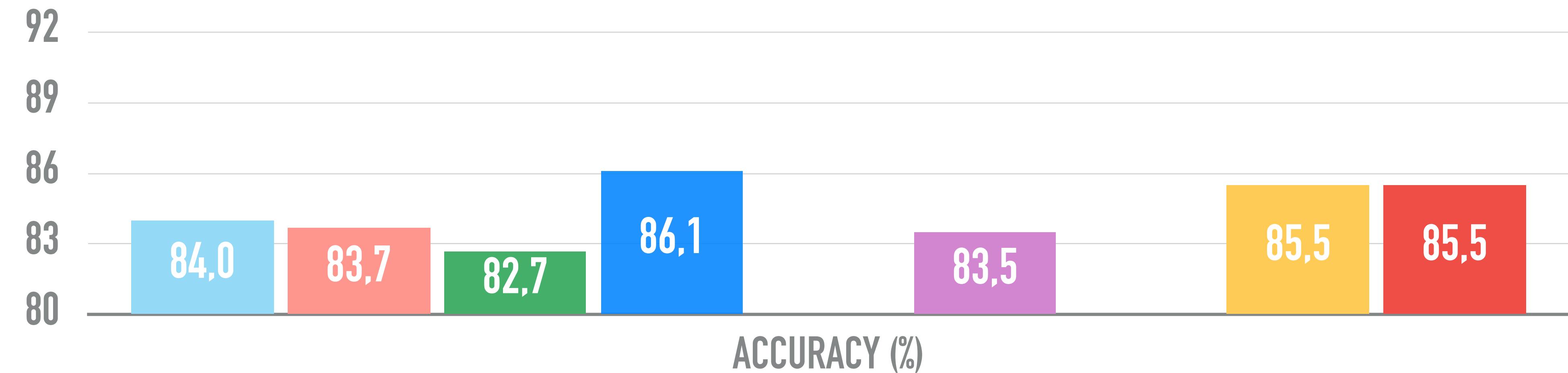
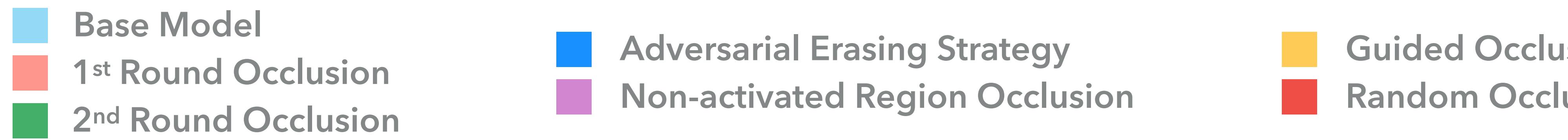
Inception-ResNet V2 (ImageNet weights)



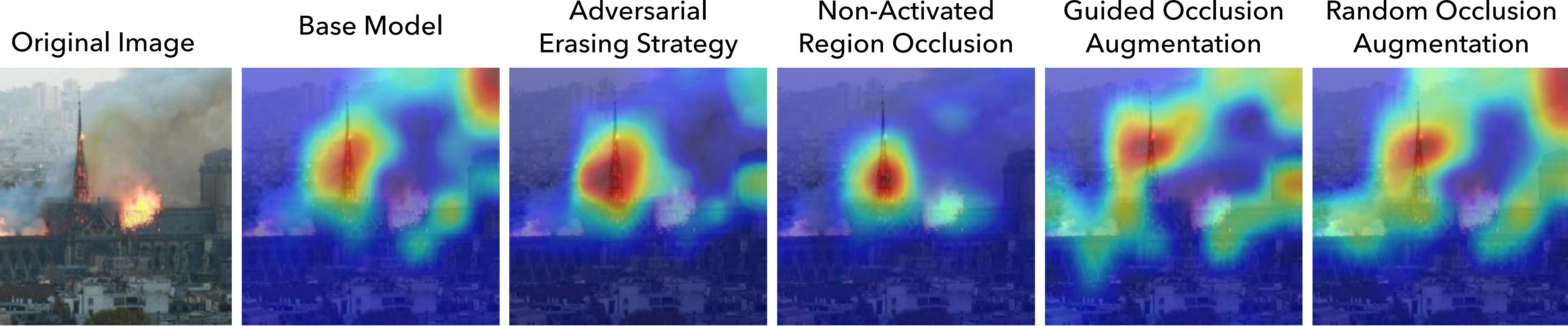
Adam optimizer (learning rate = 0.0001, $\beta_1 = 0.9$, $\beta_2 = 0.999$)

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

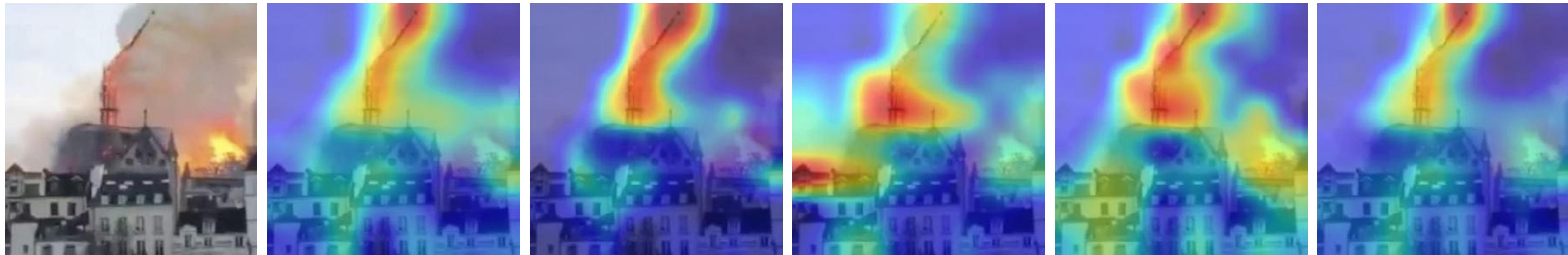
NOTRE-DAME CATHEDRAL FIRE - RESULTS



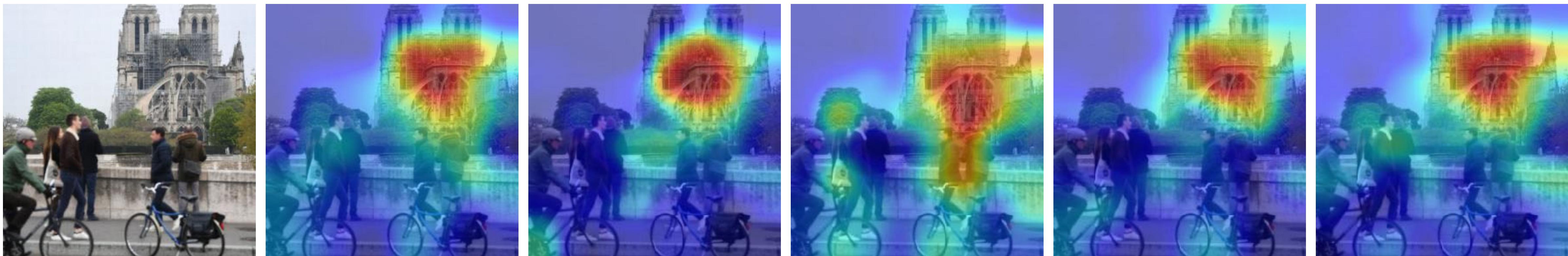
Spire on fire



Spire collapsing



Fire extinguished



CONCLUSIONS

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;
- Supressing 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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