

# Pictures

Arthur Charpentier

UQAM

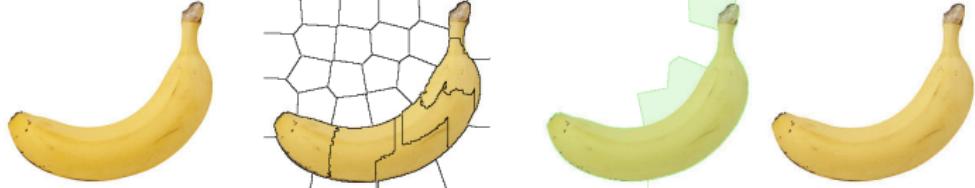
Actuarial Summer School 2019

## Picture Classifier

The algorithm is trained on tagged picture, i.e.  $(x_i, y_i)$  where here  $y_i$  is some class of fruits (banana, apple, kiwi, tomatoe, lime, cherry, pear, lychee, papaya, etc)



The challenge is to provide a new picture ( $x_{n+1}$  and to see the prediction  $\hat{y}_{n+1}$ )



See [fruits-360/Training](#), e.g. the banana (118)

## Picture Classifier

We can build a **class activation map**, <http://gradcam.cloudcv.org> see Selvaraju *et al.* (2016, *Visual Explanations from Deep Networks via Gradient-based Localization*)

Compute the gradient of the score for class  $c$ ,  $y_c$  (before softmax), with respect to feature maps  $A^k$  of convolutional layer,  $\frac{\partial y_c}{\partial A^k}$

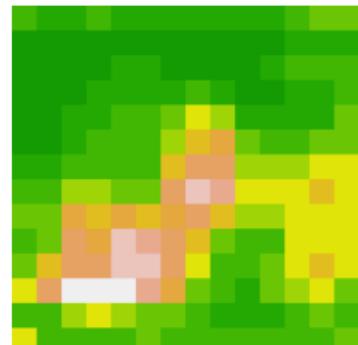
Define the importance weights as an average of gradients

$$\alpha_{c,k} = \frac{1}{n_x n_y} \sum_i \sum_j \frac{\partial y_c}{\partial A_{i,j}^k}$$

and define

$$\text{relu} \left( \sum_k \alpha_{c,k} A^k \right)$$

On a  $14 \times 14$  grid, we obtain the picture on the right



# Picture Classifier

```
7 model <- application_vgg16(weights = "imagenet")  
8 preds <- model %>% predict(img)
```

Using the pre-trained **VGG16** network  
on imangenet dataset (55,3467,096 pictures)

```
9 imagenet_decode_predictions(preds)  
10   class_name      class_desc      score  
11 1  n03594945      jeep          0.336  
12 2  n02814533      beach_wagon    0.197  
13 3  n03100240      convertible    0.153  
14 4  n03930630      pickup         0.062  
15 5  n03770679      minivan        0.041
```

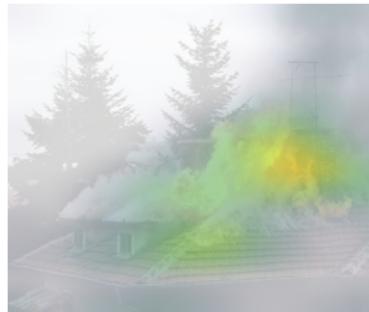


# Picture Classifier

```
2 img_path <- "house-fire.png"
```

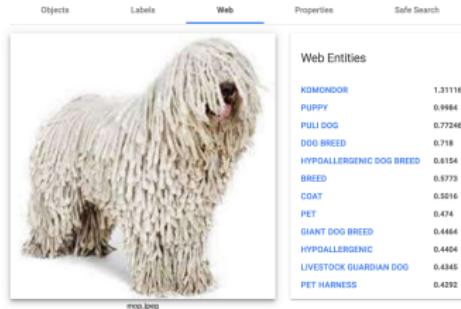
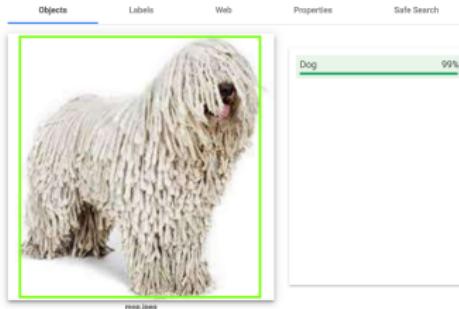
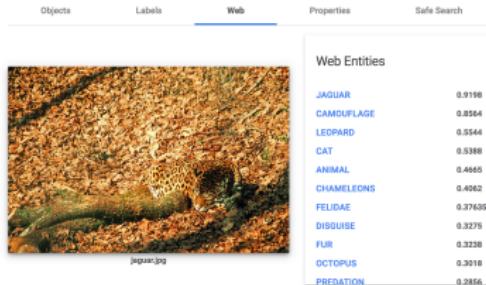
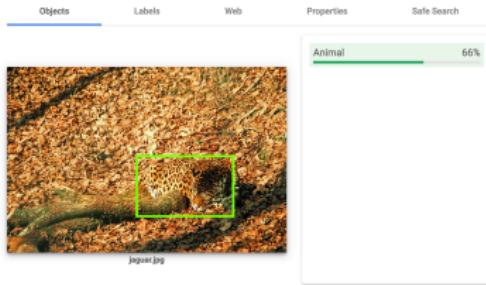
Using the pre-trained **VGG16** network  
on imangenet dataset (55,3467,096 pictures)

```
2 imagenet_decode_predictions(preds)
3   class_name  class_description score
4 1 n09472597      volcano    0.414
5 2 n09288635      geyser     0.320
6 3 n03773504      missile    0.104
7 4 n04310018 steam_locomotive 0.051
8 5 n04008634      projectile 0.045
```



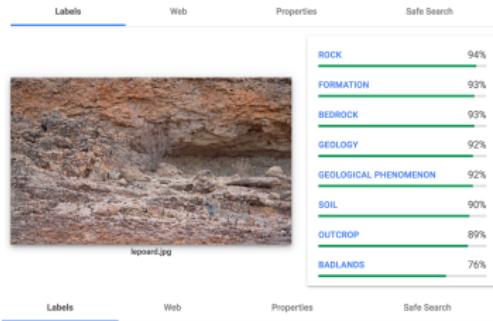
# Picture Classifier

via <https://cloud.google.com/vision/>



# Picture Classifier

via <https://cloud.google.com/vision/>



Labels



leopard.jpg

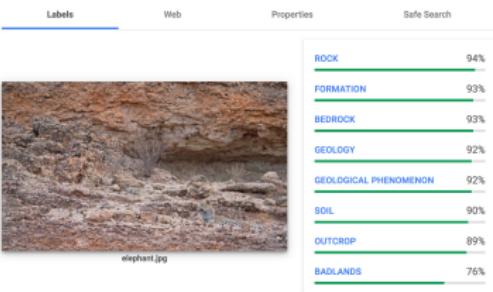
Web

Properties

Safe Search

Web Entities

LEOPARD	1.0764
CAMOUFLAGE	0.5771
SNOW LEOPARD	0.4064
ANIMAL	0.3771
CHEETAH	0.37095
IMAGE	0.3262
BIG CAT	0.3199
PHOTOGRAPH	0.247
SNIPER	0.2375
DISGUISE	0.1984
PHOTOGRAPHY	0.1973



Labels



elephant.jpg

Web

Properties

Safe Search

Web Entities

LEOPARD	1.0749
CAMOUFLAGE	0.5642
CHEETAH	0.4707
BIG CAT	0.3641
ANIMAL	0.357
IMAGE	0.3507
SNOW LEOPARD	0.3228
PHOTOGRAPH	0.264
SNIPER	0.2514
DISGUISE	0.1985
PHOTOGRAPHY	0.1954

where is the leopard?

# Noisy Pictures

Problem of distorting pictures with random noise,  
<http://karpathy.github.io/>

