Exam image/video analysis

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Question 1

A researcher has performed a network analysis on the dataset of exercise 6.2 (similar to your analysis) and now likes to know whether we can find different types of video thumbnails in different communities. In order to answer that question, she wants to categorize the video thumbnails using image classification.

Design a classification scheme (with clear definitions and examples) for categorizing video thumbnails in nodes.csv [column video_thumbnail]. Make sure that your classification scheme could be used by someone who hasn't seen the data before.

• An overview of the classification scheme (ca. 250 words)

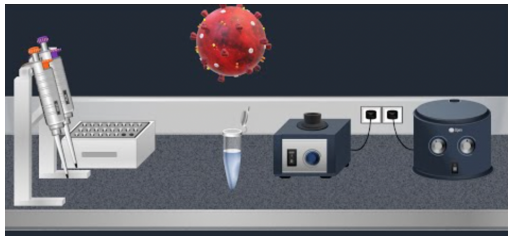
To have an idea about the images of the video thumbnails in nodes.csv, I do the following object detection to see the objects with highest probabilities in each image because it is hard to look at all the 2450 pictures one by one. During the process, I find there are some video thumbnails which are missing (`HTTP Error 404: Not Found`) and I mark them as noises. However, even all these images are created by the same query: "pcr test reliable" by YouTube recommendation algorithm, we can find there are a number of different features and types between these videos. Though the object detection can't completely detect specific object, but it provides us the insights into the diversity of these images that indicate some are not related to the query, like "volcano."

```
objectProb = []
for file in tqdm(df.video_thumbnail): # loop over images
    try:
      color_image = load_image_from_url(file, color_mode='rgb', target_size=(INPUT_SHAPE_RESNET))
      color_image = np.expand_dims(color_image, axis=0) # batch size of 1
      color_image = preprocess_input(color_image) # specifically needed for ResNet50
      preds = object_classifier.predict(color_image)
      prob = []
      for index, label, probability in decode_predictions(preds, top=5)[0]:
        one = label + str(probability)
        prob.append(one)
      objectProb.append(prob)
    except:
      objectProb.append('NOISE')

df['prob'] = objectProb
```

In this case, I reckon it is hard to classify these images into specific topics because there are too much different types for machine to recognize the subtle distinctions. Instead of considering the group topics, I prefer to know whether these images are correctly relevant to the query we apply then we can investigate the accuracy of recommendation algorithm.

To construct a clear scheme, I don't only focus on the “pcr test” but have a larger scope of the topic of “Covid.” Overall, I design the classification scheme distinguishes three ways an image is framed: 1) Covid, 2) Not covid, and 3) Noise. **Covid** (label:0) means the image includes the objects or texts which are related to covid topics, like “virus”, “PCR test”, “doctor” and “face mask.” **Not covid** (label:1) means the image is not completely related to covid and without above relevant keywords and objects, for example the images with “underwear”, “volcano” or “machine.” **Noise** (label:2) represents an image is not found anymore which only show a gray logo and not meaningful. The definitions and examples are demonstrated as below.

Framing	**Definition**	**Label**
Covid	An image with objects or texts that are related to covid, e.g. “lab coat”, “doctor”, “mask”, “test tube”, “virus”, “coronavirus”, “PCR”, “self-test”, “diagnostic”, “medical”, “elisa”, “vaccine.”	0
	example:    	
Not covid	An image is not completely related to covid and without the keywords and objects of covid.	1

<table>
<tr><td></td><td colspan="2">example:
 

 
 
  </td></tr>
<tr><td rowspan="2">Noise</td><td>The video thumbnail is missing (<code>HTTP Error 404: Not Found</code>) which only show a gray logo and not meaningful.</td><td>2</td></tr>
<tr><td colspan="2">example:  </td></tr>
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• Discussion (ca. 350 words)

1) why this classification scheme would be relevant to use in the context of the analysis of exercise 6.2 (e.g. what will it learn us about this data, what kind of questions can we answer with it)

The classification scheme can provide us insights into the recommendation algorithm and analyze whether these videos are relevant to our query. Identify the images of label 1(**Not covid**) and the groups with high eccentricities in network analysis of Gephi that we did in exercise 6.2, we can discover the extremist effect of the recommendation algorithm. That means some of the images which recommended by YouTube are not completely relevant to what we look for or what we expect.

However, in my opinion, if we can apply the classification scheme to YouTube recommendation algorithm to filter out the irrelevant videos, that might be useful to improve the accuracy of recommended videos and solve the issues of falling in the trap of tales. That could upgrade the experience of users on YouTube and help people search for what they want.

2a) whether and why you think this classification model could be computationally reproduced (by a Resnet50, for example) and 2b) where there could be potential bottlenecks in reproducing this classification scheme.

Firstly, we have the data based on the same keywords (query: “pcr test reliable”) that provides machine useful pictures to learn instead of amounts of images without relevance. Secondly, we design the classification scheme with clear and objective definitions of each label that could train a logical model and learn the patterns to make justified prediction.

Nevertheless, I think there are still some bottlenecks in reproducing this classification scheme because some images contain ambiguous meanings or only have little training data (some rarely happened scenes) that might be hard for machine to distinguish and learn the pattern between label 0 and 1. Something make sense to human’s brain might be hard for machine to make association or identify and that is the irreplaceable point of human intelligence.