Automatic Thumbnail Selection for Soccer Videos using Machine Learning

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Link: https://dl.acm.org/doi/pdf/10.1145/3524273.3528182

CS – 895 – Computer Vision

Introduction

Soccer or football is the most popular world-known sport in the sports industry

Soccer Thumbnail are used in webpages and highlights in a gallery form.

Thumbnail is an image representing a video.

Thumbnail should be eye-catching and properly represent the event.

Possible Improvements and Future Work

Blur Detection: Blur detection is challenging to integrate directly into an automatic thumbnail selection pipeline.

Integration of subjective findings: It is necessary to further investigate what makes a good thumbnail for viewers

Model Performance: YOLO is another promising object detection model that we plan to integrate and test in future versions of our pipeline

Generalizability: Larger open soccer dataset, it can yield better insights.

YOLO

- YOLO (You Only Look Once)
- Object detection
- Algorithm on how the code detects objects in the image
- It looks at an entire image Only Once and detects objects
- Can detect objects very fast

YOLOv3

- Real-time object detection algorithm
- Identifies specific objects in videos, live feeds, or images
- Machine learning algorithm uses deep convolutional network to detect an object
- The system sort’s objects in images where characteristics are placed together
- Features are learned by the convolutional layers passed to the classifier to make the prediction

Laplacian Blur Detection

- Edge detector used to compute the second derivatives of an image
- Measures the rate of the first derivatives
- Determines if a change in adjacent pixel values from an edge or continuous progression
- Contain filter kernels that contain negative values in a cross pattern
- The corners are either zero or positive values, the center is either negative or positive values

Demonstration

```
mustafa@mustafa-virtual-machine:~/Desktop/host-ats/code$ python3 create_thumbnail.py -h
usage: create_thumbnail.py [-h] [-LEliteserien2019 | -LSoccernet | -xl] [-CSurma | -xc] [-IQAOcampo | -xi] [-BSVD | -BLaplacian | -xb]
                           [-dlib | -haar | -mtcnn | -dnn | -yolo | -xf] [-cuthr CLOSEUPTHRESHOLD] [-brthr BRISQUETHRESHOLD] [-logothr LOGOTHRESHOLD] [-svdthr SVDTHRESHOLD]
                           [-lapthr LAPLACIANTHRESHOLD] [-css CUTSTARTSECONDS] [-ces CUTENDSECONDS] [-nfe NUMBEROFFRAMESTOEXTRACT | -fre FRAMERATETOEXTRACT | -fpse FPSEXTRACT]
                           [-ds DOWNSCALEPROCESSINGIMAGES] [-dso DOWNSCALEOUTPUTIMAGE] [-as ANNOTATIONSECOND] [-bac BEFOREANNOTATIONSECONDSCUT] [-aac AFTERANNOTATIONSECONDSCUT]
                           [-st STATICTHUMBNAILSEC] [-fn OUTPUTFILENAME]
                           destination
```

```
mustafa@mustafa-virtual-machine:~/Desktop/host-ats/code$ python3 create_thumbnail.py ~/Downloads/changed491.mkv -yolo -BLaplacian -LEliteserien2019 -CSurma -IQAOcampo
is file
2023-05-02 19:27:00.016109: I tensorflow/core/platform/cpu_feature_guard.cc:151] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the foll
owing CPU instructions in performance-critical operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
Found 50 images belonging to 1 classes.
/home/mustafa/.local/lib/python3.10/site-packages/imquality/brisque.py:45: FutureWarning: The behavior of rgb2gray will change in scikit-image 0.19. Currently, rgb2gray allows 2D gr
ayscale image to be passed as inputs and leaves them unmodified as outputs. Starting from version 0.19, 2D arrays will be treated as 1D images with 3 channels.
  self.image = skimage.color.rgb2gray(self.image)
Thumbnail created. Filename: changed491_thumbnail.jpg
Done
```

Results

YOLOv3 Model
-LEliteserien2019
-BLaplacian
-Csurma
-IQAOcampo

YOLOv3 Model
-LSoccernet
-BLaplacian
-Csurma
-IQAOcampo

YOLOv3 Model
-LSoccernet
-BSVD
-Csurma
-IQAOcampo

Results

DNN Model
-LEliteserien2019
-BLaplacian
-Csurma
-IQAOcampo

MTCNN Model
-LEliteserien2019
-BLaplacian
-Csurma
-IQAOcampo

Future Work

- GMM (Gradient Magnitude Method) can be implemented for Blur Detection
- Faster R-CNN or SSD (Single MultiBox Detection) can be also implemented for Face Detection.

THANK YOU FOR LISTENING

ANY QUESTIONS?