# Katna

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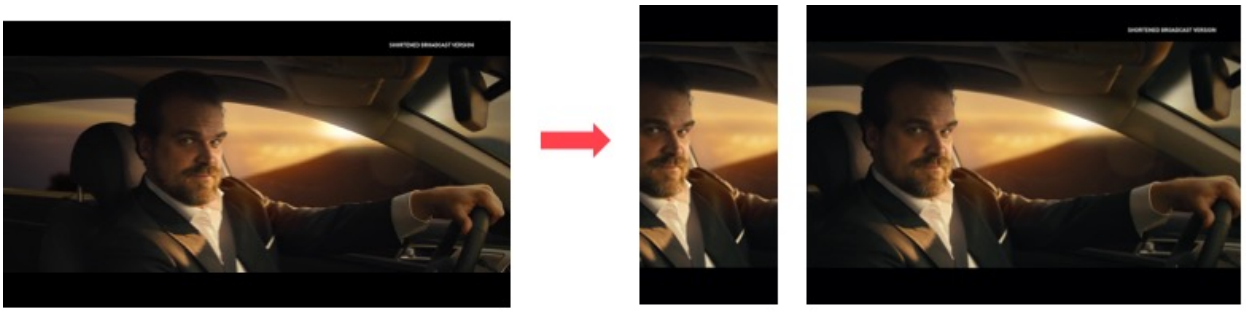
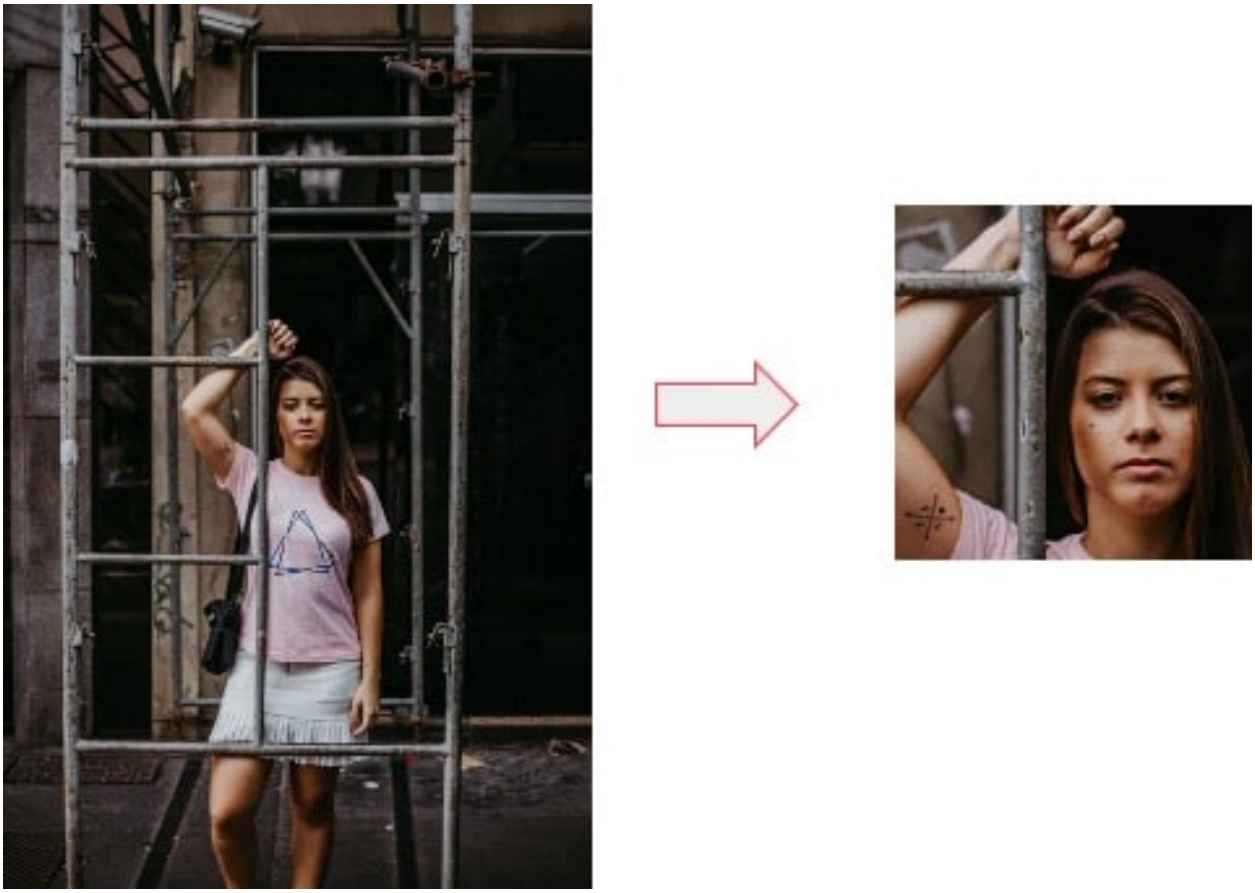
Katna automates the boring, error prone task of videos key/best frames extraction, video compression and manual time consuming task of image cropping. In summary you should consider using Katna library if you have following tasks which you want to automate:

1. You have video/videos from who you want to extract keyframe/keyframes. Please note Key-frames are defined as the representative frames of a video stream, the frames that provide the most accurate and compact summary of the video content. Take an example of this video and some of the top keyframes extracted using Katna.


2. You have video/videos you want to compress down to smaller size.
3. You have image/images which you want to smartly resize to a target resolution. (e.g. 500x500, 1080p (1920x1080) etc.)
4. You have image/images from which you want to intelligently extract a crop with a target resolution. (e.g. Get a crop of size 500x500 from image of size 1920x1080)
5. You want to extract a crop of particular aspect ratio e.g. 4:3 from your input image/images. (e.g. Get a crop of aspect ratio 1:1 from image of resolution 1920x1080 (16:9 aspect ratio image))
6. You want to resize a video to particular aspect ratio e.g. 16:9 (Landscape), to lets say to 1:1 (square). Please note that this feature is currently **experimental** and needs additional compiling and configuration of google mediapipe library.

Katna is divided into two modules namely video and image module. In next sections we will learn more about them in more details.





CHAPTER 1

# Video Module:

This module handles the task(s) for key frame(s) extraction, video compression and **experimental** feature of video resize by aspect ratio.

Key-frames are defined as the representative frames of a video stream, the frames that provide the most accurate and compact summary of the video content.

**Frame extraction and selection criteria**

1. Frame that are sufficiently different from previous ones using absolute differences in LUV colorspace
2. Brightness score filtering of extracted frames
3. Entropy/contrast score filtering of extracted frames
4. K-Means Clustering of frames using image histogram
5. Selection of best frame from clusters based on and variance of laplacian (image blur detection)

Video compression is handled using ffmpeg library. Details about which could be read in *Katna.video_compressor module* section.

Since version 0.8.0 of Katna we are extending smart resize features to videos with the help of Google's Mediapipe project. To know more about this please refer to documentation *Katna.video_resize module*. Please note that this feature is an experimental feature. And might be subject to removal/modifications at later versions. Also you also need to install Google's Mediapipe library, Specially autoflip binary for this to work. Please refer to *Smart video resize using katna* for how to install and configure mediapipe to be used with katna.

CHAPTER 2

# Image Module:

This module handles the task(s) for smart cropping and smart image resizing.

The Smart crop feature tries to automatically identify important image areas where the user will focus more and tries to retain it while cropping. For a given input cropping dimension/final output image size, following selection and filtering criteria are used.

**Crop selection and filtering criteria**

1. Edge, saliency and Face features.
2. Distance of crop from Image edge, Rule of third
3. Crop filters. At the moment only text filter is supported. Text filter ensures that cropped rectangle contains text, also it ensures that texts present is not abruptly cropped.

Similar to Smart crop Katna image module supports **Smart image resizing** feature. Given an input image and target image resolution it will perform simple image image resize if if aspect ratio is same for input and target image. But in case of aspect ratio is different than smart image resize will extract a optimum crop in target resolution and then resizes image to target resolution. This ensures image resize without actually skewing output image. **Please not that if aspect ratio of input and output image are not same katna image_resize can lead to some loss of image content**

## 2.1 Supported Video and image file formats

All the major video formats like .mp4,.mov,.avi etc and image formats like .jpg, .png, .jpeg etc are supported. Only constraint is that video should be readable by ffmpeg library and images should be readable by opencv library.

### 2.1.1 How to install

#### Using pypi

1) Install Python 3
2) Install katna from pypi using this command

```
pip install katna
```

#### Install from source

1) Install git
2) Install Anaconda or Miniconda Python
3) Open terminal
4) Clone repo from here https://github.com/keplerlab/Katna.git
5) Change the directory to the directory where you have cloned your repo

```
cd path_to_the_folder_repo_cloned
```

6) Run the setup

```
python setup.py install
```

### 2.1.2 Using Katna.video

#### Extract keyframes for a video

**Step 1**

Import the video module

```
from Katna.video import Video
```

**Step 2**

Instantiate the video class inside your main module (necessary for multiprocessing in windows)

```
if __name__ == "__main__":
    vd = Video()
```

**Step 3**

Call the **extract_video_keyframes** method. The method accepts two parameters and returns a list of numpy 2D array which are images. Refer to API reference for further details. Below are the two parameters required by the method

1. **no_of_frames**: Number of key frames to be extracted
2. **file_path**: Video file path.
3. **writer**: Writer class instance to process keyframe data for a file (use KeyFrameDiskWriter from Katna.writer module to save data at a location).

```
# initialize diskwriter to save data at desired location
diskwriter = KeyFrameDiskWriter(location="selectedframes")

vd.extract_video_keyframes(
    no_of_frames=no_of_frames_to_returned, file_path=video_file_path,
    writer=diskwriter
)
```

Code below is a complete example for a single video file.

```
from Katna.video import Video
from Katna.writer import KeyFrameDiskWriter
import os

# For windows, the below if condition is must.
if __name__ == "__main__":

  # initialize video module
  vd = Video()

  # number of images to be returned
  no_of_frames_to_returned = 12

  # initialize diskwriter to save data at desired location
  diskwriter = KeyFrameDiskWriter(location="selectedframes")

  # Video file path
  video_file_path = os.path.join(".", "tests", "data", "pos_video.mp4")

  print(f"Input video file path = {video_file_path}")

  # extract keyframes and process data with diskwriter
  vd.extract_video_keyframes(
       no_of_frames=no_of_frames_to_returned, file_path=video_file_path,
       writer=diskwriter
  )
```

### Extract keyframes for all videos in a directory

Call the **extract_keyframes_from_videos_dir** method. The method accepts three parameters and writes the data using a Writer class object. Katna comes with a default writer named "KeyFrameDiskWriter".

1. **no_of_frames**: Number of key frames to be extracted
2. **dir_path**: Directory path which has all the videos.
3. **writer**: Writer class instance to process keyframe data for a file (use KeyFrameDiskWriter from Katna.writer module to save data at a location).

```
diskwriter = KeyFrameDiskWriter(location="/path/to/output/folder")

vd.extract_keyframes_from_videos_dir(no_of_frames = no_of_frames_to_return, \
dir_path= dir_path_containing_videos, writer=diskwriter)
```

Code below is a complete example for a directory containing videos.

```
from Katna.video import Video
from Katna.writer import KeyFrameDiskWriter
import os
import ntpath

# For windows, the below if condition is must.
if __name__ == "__main__":

  #instantiate the video class
  vd = Video()

```

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```
  #number of key-frame images to be extracted
  no_of_frames_to_return = 3

  #Input Video directory path
  #All .mp4 and .mov files inside this directory will be used for keyframe extraction)
  videos_dir_path = os.path.join(".", "tests","data")

  diskwriter = KeyFrameDiskWriter(location="selectedframes")

  vd.extract_keyframes_from_videos_dir(
       no_of_frames=no_of_frames_to_return, dir_path=videos_dir_path,
       writer=diskwriter
  )
```

**Note**: You can create custom writers to process the data in a different way. Check the *Create your own writers* section for details.

### Smart video resize using katna

Please note that is it necessary to first install and initialize Google mediapipe autoflip solution before using Katna video resize (experimental) feature.

### Install Google Mediapipe library and Autoflip solution.

1. Install Mediapipe by following these instructions here.
2. Build Autoflip c++ solution by following these instructions from here.

### Resize a single video using Katna (Using Experimental Mediapipe Autoflip bridge)

#### Step 1

Import the video module

```
from Katna.video import Video
```

#### Step 2

Instantiate the video class inside your main module (necessary for multiprocessing in windows)

```
autoflip_build_path = "/absolute/path/to/autoflip/build/folder
autoflip_model_path = "/absolute/path/to/autoflip/model/folder

if __name__ == "__main__":
     vd = Video(autoflip_build_path, autoflip_model_path)
```

#### Step 3 (Optional)

Configure the mediapipe autoflip properties. To check the list of configurable options, check *Katna.video_resize module*.

```
import Katna.config as app_config

# get the current configuration
```

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```
conf = app_config.MediaPipe.AutoFlip.get_conf()

# set True for features which are required in output video
conf["ENFORCE_FEATURES"] = {
     "FACE_CORE_LANDMARKS": False,
     "FACE_ALL_LANDMARKS": False,
     "FACE_FULL": False,
     "HUMAN": False,
     "PET": False,
     "CAR": False,
     "OBJECT": False
}

# % stabalization threshold
conf["STABALIZATION_THRESHOLD"] = 0.5

# opacity of blur area
conf["BLUR_AREA_OPACITY"] = 0.6

# update configuration
app_config.MediaPipe.AutoFlip.set_conf(conf)
```

**Step 4**

Call the **resize_video** method. The method accepts three parameters and returns a status whether video resize is performed successfully or not. Refer to API reference for further details. Below are the four parameters required by the method

1. **file_path**: Video file path.
2. **abs_file_path_output**: absolute path for saving final output file.
3. **aspect_ratio**: required aspect ratio for output video. e.g. “4:3”

```
vd.resize_video(file_path = file_path, abs_file_path_output = abs_file_path_output,␣
↪aspect_ratio = aspect_ratio)
```

Code below is a complete example for a single video file.

```
from Katna.video import Video
import os

# For windows, the below if condition is must.
if __name__ == "__main__":

     # set the autoflip build and model path directory based on your installation
     # usually autoflip build is located here : /mediapipe/repo/bazel-build/mediapipe/
↪examples/desktop/autoflip
     # usually mediapipe model is located here : /mediapipe/repo/mediapipe/models
     autoflip_build_path = "/absolute/path/to/autoflip/build/folder
     autoflip_model_path = "/absolute/path/to/autoflip/model/folder

     # desired aspect ratio (e.g potrait mode - 9:16)
     aspect_ratio = 9:16

     # input video file path
     file_path = os.path.join(".", "tests", "data", "pos_video.mp4")

```

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```
    # output file to save resized video
    abs_file_path_output = os.path.join(".", "tests", "data", "pos_video_resize.mp4")

    #instantiate the video class
    vd = Video(autoflip_build_path, autoflip_model_path)

    print(f"Input video file path = {file_path}")

    vd.resize_video(file_path = file_path, abs_file_path_output = abs_file_path_
↪output, aspect_ratio = aspect_ratio)

    print(f"output resized video file path = {abs_file_path_output}")
```

**NOTE : In case of subprocess.CalledProcessError, try running the resize_video method again.**

### Resize multiple videos in a directory using Katna (Using Experimental Mediapipe Autoflip bridge)

Call the **resize_video_from_dir** method. The method accepts three parameters and returns a status whether video resize is performed successfully or not. Refer to API reference for further details. Below are the four parameters required by the method

1. **dir_path**: Directory path where videos are stored.
2. **abs_dir_path_output**: absolute path to directory where resized videos will be dumped.
3. **aspect_ratio**: required aspect ratio for output video. e.g. "4:3"

```
vd.resize_video_from_dir(dir_path = dir_path, abs_dir_path_output = abs_dir_path_
↪output, aspect_ratio = aspect_ratio)
```

Code below is a complete example for a folder full of video file.

```
from Katna.video import Video
import os

# For windows, the below if condition is must.
if __name__ == "__main__":

    # folder where videos are located
    dir_path = file_path = os.path.join(".", "tests", "data")

    # output folder to dump videos after resizing
    abs_dir_path_output = os.path.join(".", "tests", "data", "resize_results")

    # intialize video class
    vd = Video(autoflip_build_path, autoflip_model_path)

    # invoke resize for directory
    try:
        vd.resize_video_from_dir(dir_path = dir_path, abs_dir_path_output = abs_dir_
↪path_output, aspect_ratio = aspect_ratio)
    except Exception as e:
        raise e

    print(f"output resized video dir path = {abs_dir_path_output}")
```

In addition, you can also compress videos using Katna video module. Refer the how to guide on *Compress video using Katna* for details.

### 2.1.3 Using Katna.image

#### Crop a single image

**Step 1**

Import the image module.

```
from Katna.image import Image
```

**Step 2**

Instantiate the image class.

```
img_module = Image()
```

**Step 3**

Call the **crop_image** method. This method accepts following parameters (Refer to API reference for further details):

**file_path**: image file path from which crop has to be extracted

**crop_width**: width of crop to extract

**crop_height**: height of crop to extract

**no_of_crops_to_return**: number of crops rectangles to be extracted

**writer**: Writer class instance to process image crop data for a file (use ImageCropDiskWriter from Katna.writer module to save data at a location).

**filters**: You can use this **optional** parameter to filter out unwanted crop rectangles according to some filtering criteria. At the moment only "text" detection filter is implemented and more filters will be added in future will be added in future. Passing on "text" detection filter ensures crop rectangle contains text, additionally it checks that detected "text" inside an image is not abruptly cropped by any crop_rectangle. By default, filters are not applied.

**down_sample_factor**: You can use this **optional** feature to specify the down sampling factor. For large images consider increasing this parameter for faster image cropping. By default input images are downsampled by factor of **8** before processing.

```
image_file_path = <Path where the image is stored>

# diskwriter to save crop data
diskwriter = ImageCropDiskWriter(location=<Path to save crops>)

img_module.crop_image(
    file_path=image_file_path,
    crop_width=<crop_width>,
    crop_height=<crop_height>,
    num_of_crops=<no_of_crops_to_return>,
    writer=diskwriter,
    filters=<filters>,
    down_sample_factor=<number_by_which_image_to_downsample>
)
```

Code below is a complete example for a single image.

```
import os.path
import cv2
from Katna.image import Image
from Katna.writer import ImageCropDiskWriter

# Extract specific number of key frames from video
img_module = Image()

# folder to save extracted images
output_folder_cropped_image = "selectedcrops"

# number of images to be returned
no_of_crops_to_returned = 3

# crop dimentions
crop_width = 1100
crop_height = 600

# Filters
filters = ["text"]
# Image file path
image_file_path = os.path.join(".", "tests", "data", "bird_img_for_crop.jpg")
print(f"image_file_path = {image_file_path}")

# diskwriter to save crop data
diskwriter = ImageCropDiskWriter(location=output_folder_cropped_image)

# crop the image and process data with diskwriter instance
img_module.crop_image(
    file_path=image_file_path,
    crop_width=crop_width,
    crop_height=crop_height,
    num_of_crops=no_of_crops_to_returned,
    writer=diskwriter,
    filters=filters,
    down_sample_factor=8
)
```

### Crop all images in a directory

To run crop image for all images in a directory, call the **crop_image_from_dir** method. This method accepts following parameters and returns a dictionary containing file path as key and list of crop rectangles (in crop_rect data structure) as its values. Below are the six parameters of the function

**dir_path**: directory path where images from which crop has to be extracted

**crop_width**: width of crop to extract

**crop_height**: height of crop to extract

**no_of_crops_to_return**: number of crops rectangles to be extracted

**writer**: Writer class instance to process image crop data for a file (use ImageCropDiskWriter from Katna.writer module to save data at a location).

**filters**: You can use this **optional** parameter to filter out unwanted crop rectangles according to some filtering criteria. At the moment only "text" detection filter is implemented and more filters will be added in future will be added in

future. Passing on "text" detection filter ensures crop rectangle contains text, additionally it checks that detected "text" inside an image is not abruptly cropped by any crop_rectangle. By default, filters are not applied.

**down_sample_factor**: You can use this **optional** feature to specify the down sampling factor. For large images consider increasing this parameter for faster image cropping. By default input images are downsampled by factor of **8** before processing.

```
input_dir_path = <Path to directory where images are stored>

# diskwriter to save crop data
diskwriter = ImageCropDiskWriter(location=<Path to save crops>)

img_module.crop_image_from_dir(
    dir_path=input_dir_path,
    crop_width=<crop_width>,
    crop_height=<crop_height>,
    num_of_crops=<no_of_crops_to_return>,
    writer=diskwriter,
    filters=<filters>,
    down_sample_factor=<number_by_which_image_to_downsample>
 )
```

Code below is a complete example for a directory containing images.

```
import os.path
import cv2
import ntpath
from Katna.image import Image
from Katna.writer import ImageCropDiskWriter

img_module = Image()

# folder to save extracted images
output_folder_cropped_image = "selectedcrops"

# number of images to be returned
no_of_crops_to_return = 3

# crop dimensions
crop_width = 300
crop_height = 400

# Filters
filters = ["text"]

# Directory containing images to be cropped
input_dir_path = os.path.join(".", "tests", "data")

# diskwriter to save crop data
diskwriter = ImageCropDiskWriter(location=output_folder_cropped_image)

img_module.crop_image_from_dir(
    dir_path=input_dir_path,
    crop_width=crop_width,
    crop_height=crop_height,
    num_of_crops=no_of_crops_to_return,
    writer=diskwriter,
    filters=filters,
```

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```
    down_sample_factor=8
)
```

**Note**: You can create custom writers to process the data in a different way. Check the *Create your own writers* section for details.

### Resize a single image

#### Step 1

Import the image module.

```
from Katna.image import Image
```

#### Step 2

Instantiate the image class.

```
img_module = Image()
```

#### Step 3

Call the **resize_image** method. This method accepts following parameters and returns a in memory resized image in opencv format. Refer to API reference for further details. Below are the four parameters of the function

**file_path**: image file path from which crop has to be extracted

**target_width**: width of target image

**target_height**: height of target image

**down_sample_factor**: You can use this **optional** feature to specify the down sampling factor. For large images consider increasing this parameter for faster image resize and crop. By default input images are downsampled by factor of **8** before processing.

```
image_file_path = <Path where the image is stored>

crop_list = img_module.resize_image(
    file_path=image_file_path,
    target_width=<target_width>,
    target_height=<target_height>,
    down_sample_factor=<number_by_which_image_to_downsample>
)
```

#### Step 4

To save the extracted resized image call **save_image_to_disk** method. The method accepts following parameters and doesn't returns anything. Refer to API reference for further details.

1. **image**: output image to be saved
2. **file_path**: Folder location where files needs to be saved
3. **file_name**: File name for the crop image to be saved.
4. **file_ext**: File extension indicating the file type for example - '.jpg'

```
img_module.save_image_to_disk(image=<image>, file_path=<output_folder_cropped_image>,
       file_name=<file_name>,
       file_ext=<file_ext>,
   )
```

Code below is a complete example for a single image.

```
import os.path
import cv2
from Katna.image import Image

def main():

    # Extract specific number of key frames from video
    img_module = Image()

    # folder to save extracted images
    output_folder_cropped_image = "resizedimages"

    if not os.path.isdir(os.path.join(".", output_folder_cropped_image)):
        os.mkdir(os.path.join(".", output_folder_cropped_image))

    # crop dimentions
    resize_width = 500
    resize_height = 600

    # Image file path
    image_file_path = os.path.join(".", "tests", "data", "bird_img_for_crop.jpg")
    print(f"image_file_path = {image_file_path}")

    resized_image = img_module.resize_image(
        file_path=image_file_path,
        target_width=resize_width,
        target_height=resize_height,
        down_sample_factor=8,
    )
    # cv2.imshow("resizedImage", resized_image)
    # cv2.waitKey(0)

    img_module.save_image_to_disk(
        resized_image,
        file_path=output_folder_cropped_image,
        file_name="resized_image",
        file_ext=".jpeg",
    )

main()
```

### Resize all images in a directory

To run resize image for all images in a directory, call the **resize_image_from_dir** method. This method accepts following parameters and returns a dictionary containing file path as key and resized image (in opencv numpy format) as its values. Below are the six parameters of the function

**dir_path**: directory path where images from which crop has to be extracted

**target_width**: width of output resized image

**target_height**: height of output resized image

**down_sample_factor**: You can use this **optional** feature to specify the down sampling factor. For large images consider increasing this parameter for faster image cropping and resizing. By default input images are downsampled by factor of **8** before processing.

```
input_dir_path = <Path to directory where images are stored>

crop_list = img_module.resize_image_from_dir(
   dir_path=input_dir_path,
   target_width=<target_width>,
   target_height=<target_height>,
   down_sample_factor=<number_by_which_image_to_downsample>
)
```

Code below is a complete example for a directory containing images.

```
import os.path
from Katna.image import Image
import os
import ntpath


def main():

    img_module = Image()

    # folder to save resized images
    output_folder_resized_image = "resizedimages"

    if not os.path.isdir(os.path.join(".", output_folder_resized_image)):
        os.mkdir(os.path.join(".", output_folder_resized_image))

    # resized image dimensions
    resize_width = 500
    resize_height = 600

    # Input folder file path
    input_folder_path = os.path.join(".", "tests", "data")
    print(f"input_folder_path = {input_folder_path}")

    resized_images = img_module.resize_image_from_dir(
        dir_path=input_folder_path,
        target_width=resize_width,
        target_height=resize_height,
        down_sample_factor=8,
    )

    for filepath, resized_image in resized_images.items():
        # name of the image file
        filename = ntpath.basename(filepath)
        name = filename.split(".")[0]
        # folder path where the images will be stored
        img_module.save_image_to_disk(
            resized_image, output_folder_resized_image, name + "_resized" + "_", ".
↪jpeg"
        )

```

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```

main()
```

In addition, image module also has some additional features:

1. Crop Image using cv: check *Crop Image using CV*
2. Crop Image maintaining asepct ratio: check *Crop Image using aspect ratio*

### 2.1.4 Understanding katna

As mentioned in intro section katna consists of two modules, Video and Image, In this section we will go into details about each modules working.

#### Katna.video Module:

Video module handles the task(s) for key frame(s) extraction and video compression. This module has four primary public functions for keyframe extraction video_compression, which are **extract_video_keyframes**, **extract_keyframes_from_videos_dir**, **compress_video** and **compress_videos_from_dir**.

**extract_video_keyframes** is the primary function which given a video file extracts most important keyframe from a video. **extract_keyframes_from_videos_dir** actually runs extract_video_frames function for all video files in a directory recursively. Katna.video frame extraction feature first takes a video and divides a big video in smaller chunks of videos, it runs video frame extraction and frame selector tasks on these chunked videos in parallel. For each chunked video actual frame extraction is done in Katna by following two separate modules.

Details about public **compress_video** and **compress_videos_from_dir** functions is listed in *Katna.video_compressor module*.

#### Katna.frame_extractor module

In frame extractor module given a input video all the video frames that are sufficiently different from previous ones using absolute differences in LUV colorspace are returned.

#### Katna.frame_selector module

In Katna.frame_selector module given list of frames returned from frame_extractor module following checks are performed:

1. Brightness score filtering of extracted frames.
2. Entropy/contrast score filtering of extracted frames.

Each of these properties are filtered based on threshold which you can check and edit in Katna.config.ImageSelector properties.

After frame filtering based on number of required frames N, N clusters are formed using K-Means clustering where K=N, clustering is done using image histogram based approach. After K-Means clustering, for each cluster selection of best frame from cluster is done using variance of laplacian sorting. In image processing world variance of laplacian method is often used for image blur detection. This sorting and selection ensures that least blurred image is selected from cluster.

### Katna.video_compressor module

Apart from Frame extraction Katna.video module can also do efficient video compression. It is done by internal module called internally by Katna.video_compressor module and exposed publicly by two public functions: **compress_video** and **compress_videos_from_dir** As the name suggests **compress_video** function does video compression on a single input video file and **compress_videos_from_dir** function recursively compresses all videos in a given input folder. Katna.video_compressor includes actual implementation of video compression using ffmpeg library.

As discussed **compress_video** functions can compress a given input video and saves the output in same folder with name=original_input_file_name + "_compressed" with mp4 extension. You can change this behavior and other Configurations using optional parameters.

In case you play around with the different parameters like where to save compressed file etc. you can change optional parameters in compress_video function. Below are the optional parameters supported by the method

1. **force_overwrite** (bool, optional) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False

2. **crf_parameter** (int, optional) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter

3. **output_video_codec** (str, optional) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec

4. **out_dir_path** (str, optional) – output folder path where you want output video to be saved, defaults to ""

5. **out_file_name** (str, optional) – output filename, if not mentioned it will be same as input filename, defaults to ""

### Katna.video_resize module

As mentioned in home section since version 0.8.0 of Katna we are extending smart resize features to videos with the help of Google's Mediapipe project. In simple terms video resize functionality in Katna currently is a thin python wrapper around Google Mediapipe Autoflip solution. If you want to learn more about how it works under the hood Please refer to this blog post by Google AI: https://ai.googleblog.com/2020/02/autoflip-open-source-framework-for.html . Please refer to *Smart video resize using katna* for how to install and configure mediapipe to be used with katna. Right now following parameters are configurable using Katna video module:

1. **STABALIZATION_THRESHOLD** (float, optional) – defaults to "0.5" : This parameter controls extent of motion stabilization is applied while tracking an object or face across the frames for video resizing. Higher value Means more aggressive motion stabilization and vice versa.
2. **BLUR_AREA_OPACITY** (int, optional) – defaults to "0.6" In some cases e.g. while compulsorily including all faces across frames, it is not possible to do without rendering padding in video. In case overlay of same video content is used as padding. This parameter controls how much opacity to add to padded content.
3. **ENFORCE_FEATURES.FACE_CORE_LANDMARKS** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all face present in video are compulsorily included in final resized video.
4. **ENFORCE_FEATURES.FACE_FULL** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all full faces present in video are compulsorily included in final resized video.
5. **ENFORCE_FEATURES.HUMAN** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all persons/humans present/detected in video are compulsorily included in final resized video.

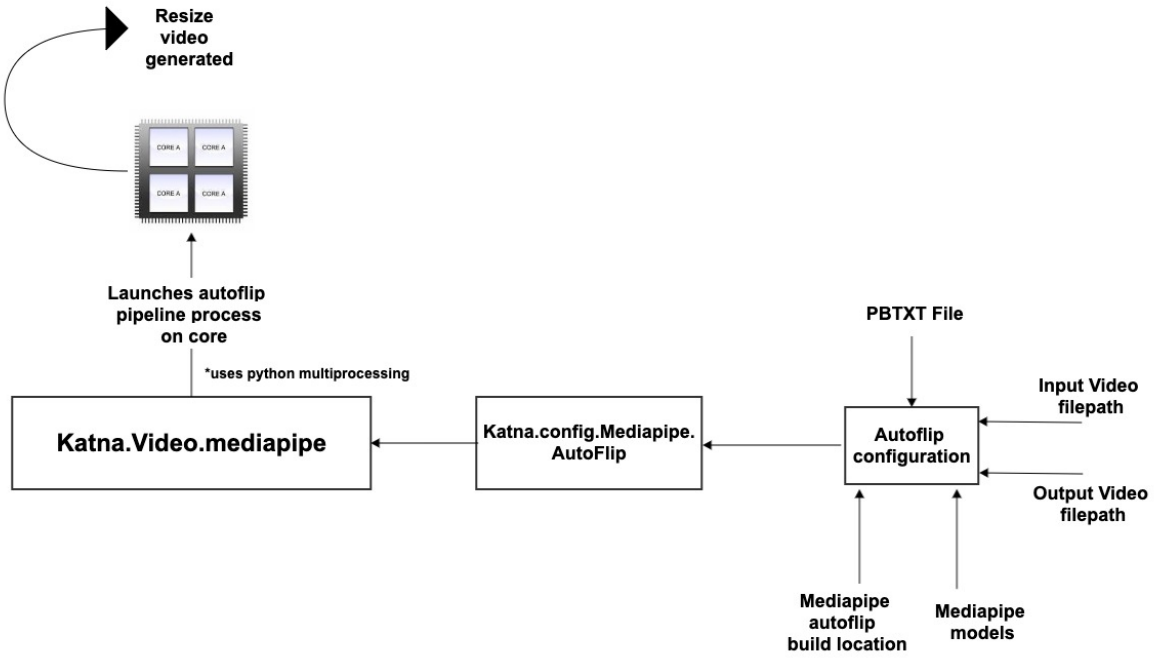
6. **ENFORCE_FEATURES.PET** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all PET's like dogs and cats present/detected in video are compulsorily included in final resized video.
7. **ENFORCE_FEATURES.CAR** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all CARs present/detected in video are compulsorily included in final resized video.
8. **ENFORCE_FEATURES.OBJECT** (bool, optional) – defaults to **False** In case of this parameter set as true, It is ensured that all objects detected in video are compulsorily included in final resized video.

### Mediapipe Autoflip Integration

Katna uses python multiprocessing to create a pool of processes based on the number of cpu cores on machine, and launch processes to resize video on these cores. For example on a 12 core machine, if 4 videos needs to be resized in parallel, Katna will launch mediapipe autoflip pipeline for 4 videos on 4 cores.

Since mediapipe is installed outside of Katna, mediaipie autoflip pipeline is launched using the python subprocess module. To ensure smooth run, Katna needs build autorun directory path (where binaries are build) and also the mediapipe models directory which containe tflite (tensorflow lite models for CPU). Internally, Katna creates a simlink to the models folder directory during its instance of execution. This allow Katna to access the models file required to run autoflip pipeline.

Below you can see a simple architecture describing the integration:




Katna provides an interface to configure autoflip. This enables Katna to hide the complexity of autoflip graphs configuration (.pbtxt file) and provide users will relevant configurations in the form of python friendly dictionary. Behind the scenes, Katna will create a temporary graph (.pbtxt) file based on the configuration provided and use it to run the autoflip pipeline.

Katna users can check **temp_pbtxt** directory when the pipeline is running to look at the mediapipe autoflip graph file. The folders gets deleted automatically when the pipeline finishes its execution.

To check the list of configurable options, check *Katna.video_resize module*.

#### Katna.image Module:

This module handles the task(s) for smart cropping. The Smart crop feature tries to automatically identify important image areas where the user will focus more and tries to retain it while cropping. For a given input cropping dimension/final output image size, Katna.image works by first extracting all possible image crop given crop specification using katna.crop_extractor module, Katna.crop_selector module then uses various filtering and selection criteria to select best crops from list of image crops. Let's read more about these two modules in details.

#### Katna.crop_extractor module

Katna.crop_extractor module works by given a crop specification using a sliding window approach it first calculates all possible crop see **_get_all_possible_crops()** function inside Katna.crop_extractor module. Additionally it applies rule of third and crop rectangle distance from edge score. Configurations related to these scoring rules could be edited in Katna.config.CropScorer module.

#### Katna.crop_selector module

After returning candidate crops from crop_extractor module Katna.crop_selector module first does further filtering using Katna.image_filters filters. At the moment only text filter is supported. Text filter ensures that if cropped rectangle contains text, texts present is not abruptly cropped.

After performing crop_filtering crop selection is done by first calculating additional crop scoring is done based on following criteria: Saliency, edge features and Face features. This score is then combined with rule of third and crop distance from edge feature calculated in crop_extractor module. Configurations related to these scoring rules could be edited in Katna.config.CropScorer, Katna.config.EdgeFeature, Katna.config.FaceFeature modules.

### 2.1.5 How to guide

#### Create your own writers

To add custom writer, extend the **Writer** class implemented in Katna.writer. The writer needs to implement the **write** method, which receives the filepath of the input file and the data generated by the Katna Library.

Below is one example where a custom writer is created to prints data instead of writing it on disk. This example uses keyframe extraction feature:

```
from Katna.video import Video
from Katna.writer import Writer
import os
import ntpath

# PrintDataWriter will print the data generated by Katn alibrary
class PrintDataWriter(Writer):
"""Custom writer to print the data
"""

    def write(self, filepath, data):
    """The write method to process data generated by Katna Library
    """
        for counter, img in enumerate(data):
```

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```
            print("Data for file: ", filepath, " is : ", data)


#instantiate the video class
vd = Video()

#number of key-frame images to be extracted
no_of_frames_to_return = 3

#Input Video directory path
#All .mp4 and .mov files inside this directory will be used for keyframe extraction)
videos_dir_path = os.path.join(".", "tests","data")

# initialize the print writer
printwriter = PrintDataWriter()


vd.extract_keyframes_from_videos_dir(
        no_of_frames=no_of_frames_to_return, dir_path=videos_dir_path,
        writer=printwriter
)
```

In this example, we have extended **KeyFrameDiskWriter** to change the naming convention of saved files. To do this, overwrite the **generate_output_filename** method. For KeyFrameDiskWriter, this method takes 2 arguments: filepath and keyframe_number. Let's add a suffix to the filename generated in teh example:

```
from Katna.video import Video
from Katna.writer import KeyFrameDiskWriter
import os
import ntpath

class CustomDiskWriter(KeyFrameDiskWriter):
"""Custom disk writer to save filename differently

:param KeyFrameDiskWriter: Writer class to overwrite
:type KeyFrameDiskWriter: Writer
"""

    # This method is used to generate output filename for a keyframe
    # Here we call the super on te base class and add a suffix
    def generate_output_filename(self, filepath, keyframe_number):
        """Custom output filename method

        :param filepath: [description]
        :type filepath: [type]
        """
        filename = super().generate_output_filename(filepath, keyframe_number)

        suffix = "keyframe"

        return "_".join([filename, suffix])
```

**Note: The similar writer approach can be used in conjuction with Katna Image module.**

### Compress video using Katna

#### Step 1

Import the video module

```
from Katna.video import Video
```

#### Step 2

Instantiate the video class inside your main module (necessary for multiprocessing in windows)

```
if __name__ == "__main__":
    vd = Video()
```

#### Step 3

Call the **compress_video** method. The method accepts one required parameter that is path to input file returns status whether compression was done successfully or not. Refer to API reference for further details. Below are the parameters required by the method

1. **file_path**: Input video full file path. This is the only compulsory parameter

```
status = vd.compress_video(file_path= video_file_path)
```

#### Step 4 (Optional)

In case you play around with the different parameters like where to save compressed file etc. you can change optional parameters in compress_video function. Refer to API reference for further details. Below are the optional parameters supported by the method

1. **force_overwrite** (bool, optional) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False

2. **crf_parameter** (int, optional) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter

3. **output_video_codec** (str, optional) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec

4. **out_dir_path** (str, optional) – output folder path where you want output video to be saved, defaults to “”

5. **out_file_name** (str, optional) – output filename, if not mentioned it will be same as input filename, defaults to “”

```
vd.compress_video(file_path, force_overwrite=False, \
crf_parameter=23, output_video_codec='libx264', out_dir_path='', out_file_name='')
```

Code below is a complete example for a single video file.

```
1  import os
2  from Katna.video import Video
3
4  def main():
5
```

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```
        vd = Video()

        # folder to save extracted images
        output_folder_for_compressed_videos= "compressed_folder"
        out_dir_path = os.path.join(".", output_folder_for_compressed_videos)

        if not os.path.isdir(out_dir_path):
             os.mkdir(out_dir_path)

        # Video file path
        video_file_path = os.path.join(".", "tests", "data", "pos_video.mp4")
        print(f"Input video file path = {video_file_path}")

        status = vd.compress_video(
             file_path=video_file_path,
             out_dir_path=out_dir_path
        )


  if __name__ == "__main__":
        main()
```

### Compress all videos in folder using Katna

#### Step 1

Import the video module

```
from Katna.video import Video
```

#### Step 2

Instantiate the video class inside your main module (necessary for multiprocessing in windows)

```
if __name__ == "__main__":
     vd = Video()
```

#### Step 3

Call the **compress_videos_from_dir** method. The method accepts one required parameter that is path to input folder where videos needs to be picked for compression returns status whether compression was done successfully or not. Refer to API reference for further details. Below are the parameters required by the method

1. **dir_path**: Input videos full folder path. This is the only compulsory parameter

```
status = vd.compress_videos_from_dir(dir_path=input_video_folder_path)
```

#### Step 4 (Optional)

In case you play around with the different parameters like where to save compressed file etc. you can change optional parameters in compress_video function. Refer to API reference for further details. Below are the optional parameters supported by the method

1. **force_overwrite** (bool, optional) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False

2. **crf_parameter** (int, optional) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is

recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter

3. **output_video_codec** (str, optional) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec

4. **out_dir_path** (str, optional) – output folder path where you want output video to be saved, defaults to “”

```
vd.compress_videos_from_dir(dir_path, force_overwrite=False, \
crf_parameter=23, output_video_codec='libx264', out_dir_path='')
```

Code below is a complete example for a single video file.

```
import os
from Katna.video import Video

def main():

      vd = Video()

      # folder to save extracted images
      output_folder_for_compressed_videos= "compressed_folder"
      out_dir_path = os.path.join(".", output_folder_for_compressed_videos)

      if not os.path.isdir(out_dir_path):
            os.mkdir(out_dir_path)

      # Video file path
      video_folder_path = os.path.join(".", "tests", "data")
      print(f"Input video folder path = {video_folder_path}")

      status = vd.compress_videos_from_dir(
            dir_path=video_folder_path,
            out_dir_path=out_dir_path
      )


if __name__ == "__main__":
      main()
```

### Crop Image using CV

You can use **crop_image_from_cvimage** function in case you want to crop in-memory images. This method accepts opencv image as image source. Rest of the parameters are same as **crop_images** method. This function helps in connecting smart image cropping to any existing workflow.

```
img = cv2.imread(image_file_path)

crop_list = img_module.crop_image_from_cvimage(
    input_image=img,
    crop_width,
    crop_height,
```

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```
    num_of_crops,
    filters=[],
    down_sample_factor=config.Image.down_sample_factor,
)
```

### Crop Image using aspect ratio

If you want to get the crops by a specified aspect ratio. You can use **crop_image_with_aspect** function. This method accepts **crop_aspect_ratio** as parameter instead of height & width and returns a list of crop rectangles wrt to each crop dimension it finds with the specified aspect ratio.

**crop_aspect_ratio**: use this parameter to specify the aspect ratio by which crops need to be extracted.The parameter expects you to specify the aspect ratio in string format eg. '4:3' or '16:9'.

```
from Katna.writer import ImageCropDiskWriter
diskwriter = ImageCropDiskWriter(location="selectedcrops")

image_file_path = <Path where the image is stored>
crop_aspect_ratio = '4:3'

crop_list = img_module.crop_image_with_aspect(
    file_path=image_file_path,
    crop_aspect_ratio=<crop_aspect_ratio>,
    num_of_crops=<no_of_crops_to_return>,
    writer=diskwriter,
    filters=<filters>,
    down_sample_factor=<number_by_which_image_to_downsample>
)
```

## 2.1.6 Tips and Troubleshooting

1) If input image is of very large size ( larger than 2000x2000 ) it might take a long time to perform Automatic smart cropping.If you encounter this issue, consider changing down_sample_factor from default 8 to larger values ( like 16 or 32 ). This will decrease processing time significantly.

2) If you get "AttributeError: module 'cv2.cv2' has no attribute 'saliency'" error. then try re-installing opencv-contrib

```
python -m pip uninstall opencv-contrib-python
python -m pip install opencv-contrib-python
```

3) If you get "FileNotFoundError: frozen_east_text_detection.pb file not found". Open python shell and follow the below commands.

```
from Katna.image_filters.text_detector import TextDetector
td = TextDetector()
td.download_data()
```

4) If you are running the code on windows, make sure to create the main file in the below format.

```
from Katna.video import Video

def main():
    vd = Video()
```

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```
    # your code...

if __name__ == "__main__":
    main()
```

OR

```
from Katna.video import Video

if __name__ == "__main__":

    vd = Video()
    # your code
```

5) On windows, ensure that anaconda has admin rights if installing with anaconda as it fails with the write permission while installing some modules.

6) If you get "RuntimeError: No ffmpeg exe could be found. Install ffmpeg on your system, or set the IMAGEIO_FFMPEG_EXE environment variable". Go to the **imageio-ffmpeg-*.egg** folder inside your **site-packages** folder, there's ffmpeg file inside binaries folder set it's path to environment variable.

7) **There is a known memory leak issue in Katna version 0.8.2 and less,** when running video keyframe extraction on Python version 3.6 and 3.7, This might be releated to some multiprocessing bug in Python 3.6 and 3.7 which is fixed in 3.8 and above. Take a look at memory usage graph of python 3.6 and 3.7.

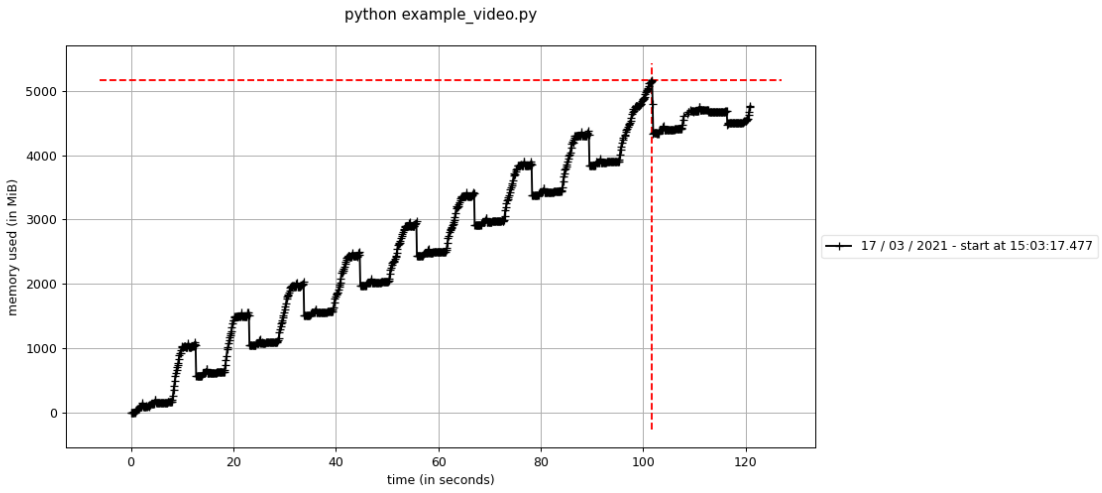


Fig. 1: Keyframe extraction on python 3.6

If you are running Keyframe extraction code on large number of videos and facing memory issue, request you to upgrade your katna version to version 0.9 or above. If you still want to use older version of katna consider upgrading your python version to 3.8 or above.

**Mediapipe Build Issues**

1) If you are unable to run the "hello-world" example for MacOS, refer to the issue reported here: https://github.com/bazelbuild/bazel/issues/8053#issuecomment-490793705 . Sometimes the build doesnt work due to openCV version or dependencies on glog.

2) Mediaipie build can also give c++ compilations errors when building using Bazel. In some situations, this happens due to prtotbuf installation on system wherein Bazel accidentally picks up header files from the system when compiling

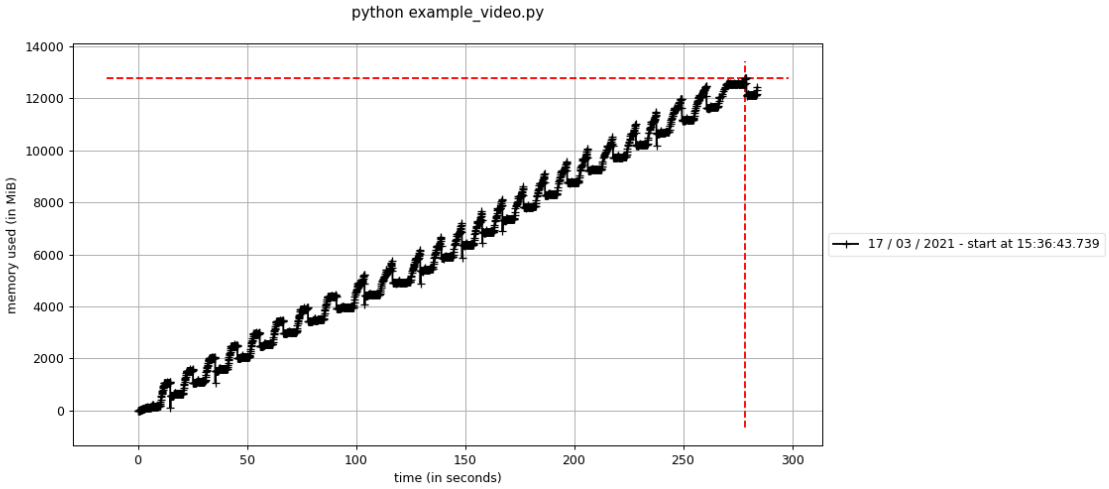


Fig. 2: Keyframe extraction on python 3.7

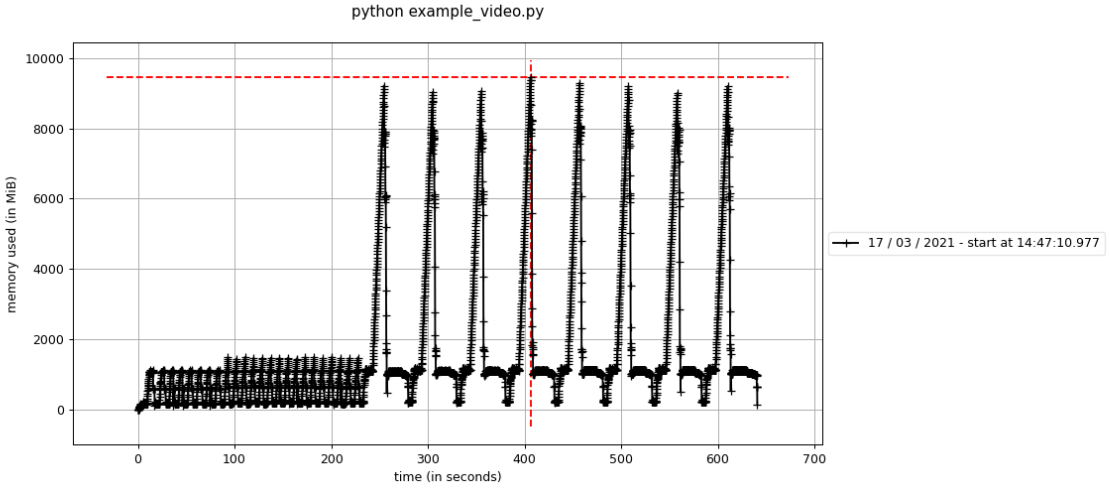


Fig. 3: Keyframe extraction on python 3.8

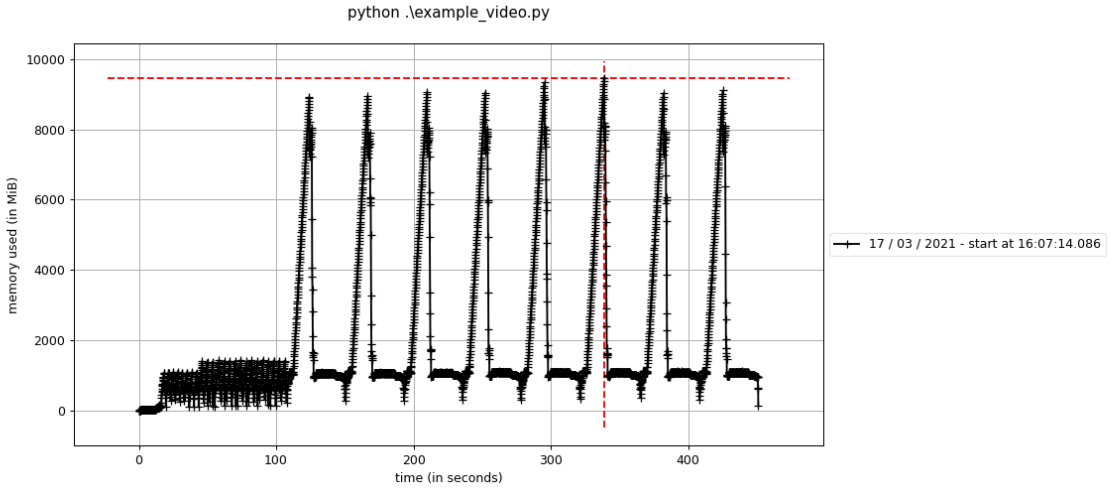


Fig. 4: Keyframe extraction on python 3.9

Bazel's checked in Protobuf C++ sources on macOS. The solution is to uninstall protobuf and is mentioned over here: https://github.com/bazelbuild/bazel/issues/8053#issuecomment-490793705

### 2.1.7 Katna

#### Main modules

#### Katna.video module

**class** Katna.video.**Video**(*autoflip_build_path=None*, *autoflip_model_path=None*)

Bases: object

Class for all video frames operations

**Parameters** **object** (class:*Object*) – base class inheritance

**compress_video**(*file_path*, *force_overwrite=False*, *crf_parameter=23*, *output_video_codec='libx264'*, *out_dir_path=''*, *out_file_name=''*)

Function to compress given input file

**Parameters**

- **file_path** (*str*) – Input file path
- **force_overwrite** (*bool, optional*) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False
- **crf_parameter** (*int, optional*) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter
- **output_video_codec** (*str, optional*) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses

more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec

- **out_dir_path** (*str, optional*) – output folder path where you want output video to be saved, defaults to “”
- **out_file_name** (*str, optional*) – output filename, if not mentioned it will be same as input filename, defaults to “”

**Raises** **Exception** – raises FileNotFoundError Exception if input video file not found, also exception is raised in case output video file path already exist and force_overwrite is not set to True.

**Returns** Status code Returns True if video compression was successfull else False

**Return type** bool

**compress_videos_from_dir**(*dir_path*, *force_overwrite=False*, *crf_parameter=23*, *output_video_codec='libx264'*, *out_dir_path=''*, *out_file_name=''*)

Function to compress input video files in a folder

**Parameters**

- **dir_path** (*str*) – Input folder path
- **force_overwrite** (*bool, optional*) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False
- **crf_parameter** (*int, optional*) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter
- **output_video_codec** (*str, optional*) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec
- **out_dir_path** (*str, optional*) – output folder path where you want output video to be saved, defaults to “”

**Raises** **Exception** – raises FileNotFoundError Exception if input video file not found, also exception is raised in case output video file path already exist and force_overwrite is not set to True.

**Returns** Status code Returns True if video compression was successfull else False

**Return type** bool

**extract_keyframes_from_videos_dir**(*no_of_frames*, *dir_path*, *writer*)

Returns best key images/frames from the videos in the given directory. you need to mention number of keyframes as well as directory path containing videos. Function returns python dictionary with key as filepath each dictionary element contains list of python numpy image objects as keyframes.

**Parameters**

- **no_of_frames** (*int, required*) – Number of key frames to be extracted
- **dir_path** (*str, required*) – Directory location with videos
- **writer** (*Writer, required*) – Writer class obj to process keyframes

**Returns** Dictionary with key as filepath and numpy.2darray Image objects

**Return type** dict

**extract_video_keyframes**(*no_of_frames*, *file_path*, *writer*)
Returns a list of best key images/frames from a single video.

**Parameters**

- **no_of_frames** (*int, required*) – Number of key frames to be extracted
- **file_path** (*str, required*) – video file location
- **writer** (*Writer, required*) – Writer object to process keyframe data

**Returns** List of numpy.2darray Image objects

**Return type** list

**extract_video_keyframes_big_video**(*no_of_frames*, *file_path*)

**Parameters**

- **no_of_frames** –
- **file_path** –

**Returns**

**Return type**

**resize_video**(*file_path*, *abs_file_path_output*, *aspect_ratio*)
Resize a single video file

**Parameters**

- **file_path** (*str*) – file path of the video to be resized
- **abs_file_path_output** (*str*) – absolute path to output video file
- **aspect_ratio** (*[type]*) – aspect ratio of the final video

**Raises** **Exception** – [description]

**resize_video_from_dir**(*dir_path*, *abs_dir_path_output*, *aspect_ratio*)
Resize all videos inside the directory

**Parameters**

- **dir_path** (*str*) – Directory path where videos are located
- **abs_dir_path_output** (*str*) – Absolute path to directory where output videos should to be dumped
- **aspect_ratio** (*[type]*) – desirable aspect ratio for the videos

**Raises** **Exception** – [description]

**save_frame_to_disk**(*frame*, *file_path*, *file_name*, *file_ext*)
saves an in-memory numpy image array on drive.

**Parameters**

- **frame** (*numpy.ndarray, required*) – In-memory image. This would have been generated by extract_video_keyframes method
- **file_name** (*str, required*) – name of the image.
- **file_path** (*str, required*) – Folder location where files needs to be saved
- **file_ext** (*str, required*) – File extension indicating the file type for example - '.jpg'

**Returns** None

### Katna.image module

**class** Katna.image.**Image**(*disable_text=True*)

Bases: object

Class for all image cropping operations

**Parameters** **object** (class:*Object*) – base class inheritance

Constructor for image files

**crop_image**(*file_path*, *crop_width*, *crop_height*, *num_of_crops*, *writer*, *filters=[]*, *down_sample_factor=8*)

smartly crops the imaged based on the specification - width and height

**Parameters**

- **file_path** (*str, required*) – Input file path
- **crop_width** (*int*) – output crop width
- **crop_height** (*int*) – output crop heigh
- **num_of_crops** (*int*) – number of crops required
- **writer** (*Writer, required*) – writer object to process data
- **filters** (*list (eg. ['text'])*) – filters to be applied for cropping(checks if image contains english text and the crop rectangle doesn't cut the text)
- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)

**Returns** crop list

**Return type** list of structure crop_rect

**crop_image_from_cvimage**(*input_image*, *crop_width*, *crop_height*, *num_of_crops*, *filters=[]*, *down_sample_factor=8*)

smartly crops the imaged based on the specification - width and height

**Parameters**

- **input_image** (*numpy array, required*) – Input image
- **crop_width** (*int*) – output crop width
- **crop_height** (*int*) – output crop heigh
- **num_of_crops** (*int*) – number of crops required
- **filters** (*list (eg. ['text'])*) – filters to be applied for cropping(only returns crops containing english text where the crop rectangle doesn't cut the text)

- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)

**Returns** crop list

**Return type** list of structure crop_rect

**crop_image_from_dir**(*dir_path*, *crop_width*, *crop_height*, *num_of_crops*, *writer*, *filters=[]*, *down_sample_factor=8*)

smartly crops all the images (inside a directory) based on the specification - width and height

**Parameters**

- **dir_path** (*str, required*) – Input Directory path
- **crop_width** (*int*) – output crop width
- **crop_height** (*int*) – output crop height
- **num_of_crops** (*int*) – number of crops required
- **writer** (*int*) – number of crops required
- **filters** (*list (eg. ['text'])*) – filters to be applied for cropping(checks if image contains english text and the crop rectangle doesn't cut the text)
- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)

**Returns** crop dict with key as filepath and crop list for the file

**Return type** dict

**crop_image_with_aspect**(*file_path*, *crop_aspect_ratio*, *num_of_crops*, *writer*, *filters=[]*, *down_sample_factor=8*)

smartly crops the imaged based on the aspect ratio and returns number of specified crops for each crop spec found in the image with the specified aspect ratio

**Parameters**

- **file_path** (*str, required*) – Input file path
- **crop_aspect_ratio** (*str (eg. '4:3')*) – output crop ratio
- **num_of_crops** (*Writer, required*) – number of crops required
- **filters** (*list (eg. ['text'])*) – filters to be applied for cropping(checks if image contains english text and the crop rectangle doesn't cut the text)
- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)
- **writer** – writer to process the image

**Returns** crop list

**Return type** list of structure crop_rect

**resize_image**(*file_path*, *target_width*, *target_height*, *down_sample_factor=8*)

smartly resizes the image based on the specification - width and height

**Parameters**

- **file_path** (*str, required*) – Input file path
- **target_width** (*int*) – output image width
- **target_height** (*int*) – output image height

- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)

**Returns** resized image

**Return type** cv_image

**resize_image_from_dir**(*dir_path*, *target_width*, *target_height*, *down_sample_factor=8*)
smartly resizes all the images (inside a directory) based on the specification - width and height

**Parameters**

- **dir_path** (*str, required*) – Input Directory path
- **target_width** (*int*) – output width
- **target_height** (*int*) – output height
- **down_sample_factor** (*int [default=8]*) – number by which you want to reduce image height & width (use it if image is large or to fasten the process)

**Returns** dict with key as filepath and resized image as in opencv format as value

**Return type** dict

**save_crop_to_disk**(*crop_rect*, *frame*, *file_path*, *file_name*, *file_ext*, *rescale=False*)
saves an in-memory crop on drive.

**Parameters**

- **crop_rect** (*crop_rect, required*) – In-memory crop_rect.
- **frame** (*numpy.ndarray, required*) – In-memory input image.
- **file_name** (*str, required*) – name of the image.
- **file_path** (*str, required*) – Folder location where files needs to be saved
- **file_ext** (*str, required*) – File extension indicating the file type for example - '.jpg'

**Returns** None

**save_image_to_disk**(*image*, *file_path*, *file_name*, *file_ext*)
saves an in-memory image obtained from image resize on drive.

**Parameters**

- **image** (*numpy.ndarray, required*) – In-memory input image.
- **file_name** (*str, required*) – name of the image.
- **file_path** (*str, required*) – Folder location where files needs to be saved
- **file_ext** (*str, required*) – File extension indicating the file type for example - '.jpg'

**Returns** None

**class** Katna.image.**UserFiltersEnum**
Bases: object

Enum class for filters

**text = 'TextDetector'**

### Config module

**class** Katna.config.**CropScorer**
Bases: object

**detail_weight = 0.2**

**edge_radius = 0.4**

**edge_weight = -20**

**face_bias = 0.01**

**face_weight = 3.4**

**outside_importance = -0.5**

**rects_weight = 1**

**rule_of_thirds = True**

**saliency_bias = 0.2**

**saliency_weight = 1.3**

**class** Katna.config.**EdgeFeature**
Bases: object

**ksize = 3**

**max_val_threshold = 200**

**min_val_threshold = 100**

**class** Katna.config.**FaceFeature**
Bases: object

**cache_subdir = 'models'**

**confidence = 0.5**

**model_file = 'res10_300x300_ssd_iter_140000_fp16.caffemodel'**

**modelfile_download_link = 'https://raw.githubusercontent.com/opencv/opencv_3rdparty/dn**

**prototxt_download_link = 'https://raw.githubusercontent.com/opencv/opencv/master/sampl**

**prototxt_file = 'deploy.prototxt'**

**class** Katna.config.**FrameExtractor**
Bases: object

**USE_LOCAL_MAXIMA = True**

**len_window = 20**

**max_frames_in_chunk = 500**

**window_type = 'hanning'**

**class** Katna.config.**Image**
Bases: object

**DEBUG = False**

**crop_height_reduction_factor_in_each_iteration = 0.05**

**down_sample_factor = 8**

**min_image_to_crop_factor = 4**

**class** Katna.config.**ImageSelector**
Bases: object

**brightness_step = 2.0**

**entropy_step = 0.5**

**max_brightness_value = 90.0**

**max_entropy_value = 10.0**

**min_brightness_value = 10.0**

**min_entropy_value = 1.0**

**class** Katna.config.**MediaPipe**
Bases: object

**class AutoFlip**
Bases: object

**BLUR_AREA_OPACITY = 0.6**

**BLUR_AREA_OPACITY_KEYNAME = 'BLUR_AREA_OPACITY'**

**BUILD_CMD = 'run_autoflip'**

**CONFIG_FILE_PBTXT = '/home/docs/checkouts/readthedocs.org/user_builds/katna/checkou**

**DEFAULT_BLUR_AREA_OPACITY = 0.6**

**DEFAULT_FEATURE_SIGNAL_VALUE = 'false'**

**DEFAULT_MOTION_STABALIZATION_THRESHOLD = 0.5**

**ENFORCE_FEATURES = {'CAR': False, 'FACE_ALL_LANDMARKS': False, 'FACE_CORE_LANDMARKS**

**ENFORCE_FEATURES_KEYNAME = 'ENFORCE_FEATURES'**

**MODELS_FOLDER_LOCATION = '/home/docs/checkouts/readthedocs.org/user_builds/katna/ch**

**RERUN_LIMIT = 2**

**STABALIZATION_THRESHOLD = 0.5**

**STABALIZATION_THRESHOLD_KEYNAME = 'STABALIZATION_THRESHOLD'**

**TMP_PBTXT_FOLDER_NAME = 'temp_pbtxt'**

**TMP_PBTXT_FOLDER_PATH = '/home/docs/checkouts/readthedocs.org/user_builds/katna/che**

**classmethod get_conf**()
Gets the current config
**Returns** dictionary containing the current config
**Return type** dict

**classmethod get_pbtxt_mapping**()

**classmethod set_conf**(*config*)
Sets the config passed
**Parameters** **config** (*dict*) – The configuration to set.

**class** Katna.config.**TextDetector**
Bases: object

**cache_subdir = 'models'**

```
    frozen_weights = 'frozen_east_text_detection.pb'
    layerNames = ['feature_fusion/Conv_7/Sigmoid', 'feature_fusion/concat_3']
    merge_threshold = 1
    min_confidence = 0.9
    model_download_link = 'https://github.com/oyyd/frozen_east_text_detection.pb/raw/maste
```

**class** Katna.config.**Video**
Bases: object

```
    DEBUG = False
    assumed_no_of_frames_per_candidate_frame = 5
    compression_output_file_extension = 'mp4'
    memory_consumption_threshold = 0.8
    min_video_duration = 5.0
    video_compression_codec = 'libx264'
    video_compression_crf_parameter = 23
    video_extensions = ['.str', '.aa', '.aac', '.ac3', '.acm', '.adf', '.adp', '.dtk', '.a
    video_split_threshold_in_minutes = 20
```

### Helper modules

### Katna.decorators module

**class** Katna.decorators.**DebugDecorators**
Bases: object

File validation decorator

**Arguments:** object {[type]} – [description]

**Raises:** None:

**Returns:** [] – [Decorated function]

**classmethod add_optional_debug_images_for_image_module**(*decorated*)
Add optional debug images in image_module class if DEBUG option is True in config

**class** Katna.decorators.**FileDecorators**
Bases: object

File validation decorator

**Raises** **FileNotFoundError** – File or path is incorrect

**classmethod validate_dir_path**(*decorated*)
Validate if the input path is a valid dir or location

**Parameters** **decorated**(*function, required*) – decorated function

**Returns** function if the path is valid

**Return type** function object

**classmethod validate_file_path**(*decorated*)
Validate if the input path is a valid file or location

**Parameters** **decorated** (*function, required*) – decorated function

**Returns** function if the path is valid

**Return type** function object

**class** Katna.decorators.**VideoDecorators**
Bases: object

File validation decorator

**Arguments:** object {[type]} – [description]

**Raises:** FileNotFoundError: [Video File is missing]

**Returns:** [boolean] – [if the file exists and is valid]

**classmethod validate_video**(*decorated*)
Validate if the input video is a valid file

Katna.decorators.**exception**(*logger*)
A decorator that wraps the passed in function and logs exceptions should one occur

param logger: The logging object type logger: logger

### Internal modules for Video

### Katna.frame_extractor module

**class** Katna.frame_extractor.**FrameExtractor**
Bases: object

Class for extraction of key frames from video : based on sum of absolute differences in LUV colorspace from given video

**extract_candidate_frames**(*videopath*)
Pubic function for this module , Given and input video path This functions Returns one list of all candidate key-frames

**Parameters**

- **object** (class:*Object*) – base class inheritance
- **videopath** (*str*) – inputvideo path

**Returns** opencv.Image.Image objects

**Return type** list

### Katna.image_selector module

**class** Katna.image_selector.**ImageSelector**(*n_processes=1*)
Bases: object

Class for selection of best top N images from input list of images, Currently following selection method are implemented: brightness filtering, contrast/entropy filtering, clustering of frames and variance of laplacian for non blurred images selection

**Parameters** **object** (class:*Object*) – base class inheritance

**select_best_frames**(*input_key_frames*, *number_of_frames*)
[summary] Public function for Image selector class: takes list of key-frames images and number of required frames as input, returns list of filtered keyframes

**Parameters**

- **object** (class:*Object*) – base class inheritance
- **input_key_frames** (*python list opencv images*) – list of input keyframes in list of opencv image format
- **number_of_frames** – Required number of images

**Type** int

**Returns** Returns list of filtered image files

**Return type** python list of images

### Katna.video_compressor module

**class** Katna.video_compressor.**VideoCompressor**
Bases: object

Class for performing video compression task: based on ffmpeg library for doing video compression

**compress_video**(*file_path*, *force_overwrite*, *crf_parameter*, *output_video_codec*, *out_dir_path*, *out_file_name*)
Function to compress given input file

**Parameters**

- **file_path** (*str*) – Input file path
- **force_overwrite** (*bool, optional*) – optional parameter if True then if there is already a file in output file location function will overwrite it, defaults to False
- **crf_parameter** (*int, optional*) – Constant Rate Factor Parameter for controlling amount of video compression to be applied, The range of the quantizer scale is 0-51: where 0 is lossless, 23 is default, and 51 is worst possible. It is recommend to keep this value between 20 to 30 A lower value is a higher quality, you can change default value by changing config.Video.video_compression_crf_parameter
- **output_video_codec** (*str, optional*) – Type of video codec to choose, Currently supported options are libx264 and libx265, libx264 is default option. libx264 is more widely supported on different operating systems and platforms, libx265 uses more advanced x265 codec and results in better compression and even less output video sizes with same or better quality. Right now libx265 is not as widely compatible on older versions of MacOS and Widows by default. If wider video compatibility is your goal you should use libx264., you can change default value by changing Katna.config.Video.video_compression_codec
- **out_dir_path** (*str, optional*) – output folder path where you want output video to be saved, defaults to “”
- **out_file_name** (*str, optional*) – output filename, if not mentioned it will be same as input filename, defaults to “”

**Raises** **Exception** – raises FileNotFoundError Exception if input video file not found, also exception is raised in case output video file path already exist and force_overwrite is not set to True.

**Returns** Status code Returns True if video compression was successfull else False

**Return type** bool

### Internal modules for Image

### Katna.crop_rect module

**class** Katna.crop_rect.**CropRect**(*x*, *y*, *w*, *h*)
Bases: object

Data structure class for storing image crop rectangles

**Parameters** **object** (class:*Object*) – base class inheritance

**get_image_crop**(*input_image*)
public functions which for given input image and current crop rectangle object returns image cropped to crop rectangle specifications.

**Parameters**

- **object** (class:*Object*) – base class inheritance
- **image** (*Opencv Numpy Image*) – input image

**Returns** cropped image according to given spec

**Return type** Opencv Numpy Image

### Katna.crop_extractor module

**class** Katna.crop_extractor.**CropExtractor**
Bases: object

Class for extraction and scoring of all possible crops from input image for input crop size. Currently features being used for scoring a given crop retangle are: Edge, saliency and face detection. Additionally crop scoring also takes following metrics into account: Distance of pixel in crop rectangle from crop boundary and rule of third.

**extract_candidate_crops**(*inputImage*, *crop_width*, *crop_height*, *feature_list*)
Public Function for crop_extractor module, Given input image and desired crop width and height: function returns list of all candidate crop rectangles scored taking into account input Image Feature list

**Parameters**

- **object** (class:*Object*) – base class inheritance
- **inputImage** (*opencv.Image*) – input Image
- **crop_width** (*Int*) – input crop width
- **crop_height** (*Int*) – input crop height
- **feature_list** (*List of OpenCV numpy image type*) – list of input feature maps to be used for scoring a crop rectangle

**Returns** List of extracted crop rectangle objects

**Return type** list of crop_rect

### Katna.crop_selector module

**class** Katna.crop_selector.**CropSelector**
Bases: object

Class for selection of top n crop rectangles from input list of crop rectangles ,It also implements filtering functionality, currently following filtering method are implemented: Text Detector filter

**Parameters** **object** (class:*Object*) – base class inheritance

**select_candidate_crops**(*input_image*, *num_of_crops*, *input_crop_list*, *defined_filters*, *filters=[]*)
Public Function for CropSelector class: takes list of crop rectangles and number of required crops as input and returns list of filtered crop retangles as output. Also takes list of filters to be used for filtering out unwanted crop rectangles as optional input.

**Parameters**

- **object** (class:*Object*) – base class inheritance
- **input_image** (*Opencv Numpy Image*) – input image
- **input_crop_list** (*python list crop_rect data structure*) – list of input crop in list of crop_rect format
- **number_of_crop** – Required number of crop

**Type** int

**Returns** Returns list of filtered crop_rect

**Return type** python list of crop_rect data structure

### Image Filters for Smart Cropping

### Katna.image_filters.filter

**class** Katna.image_filters.filter.**Filter**(*weight*)
Bases: object

Base Class for Image filters

**get_weight**()
gets weight of particular filter

**Returns** weight of the filter

**Return type** float

### Katna.image_filters.text_detector

**class** Katna.image_filters.text_detector.**TextDetector**(*weight=1.0*)
Bases: Katna.image_filters.filter.Filter

TextDetector Class: Class for implementation of text detector filter, inherit from Filter class

Constructor for this class does following tasks, if not already downloaded , it first downloads text detector dnn weights file from public URL ands save it at USER_HOME/.katna directory, or /tmp/.katna directory. After this initializer code initializes internal parameter: min_confidence (for text detection)

**download_data**()
Public function for downloading the network weight from the URL link, to be used for text detection functionality. Troubleshooting tip: If you get FileNotFound error during text detector initialization, initialize the text detector and call this function directly to download the model file from public URL link.

**get_filter_result**(*crop*)
Main public function of TextDetector filter class, this filter Returns false if crop contains no text, additionally checks for overlap between input crop rectangle and the detected text bounding box, returns True if No overlap (Filter will not discard input crop) otherwise returns False (signal for discarding input crop).

**Parameters** **crop** (*crop_rect*) – input crop rectangle to test

**Returns** True if No overlap (Filter will not discard input crop) otherwise returns False

**Return type** bool

**set_image**(*image*)
Public set_image function, This will detect all text boxes in input image and will saves them as internal list of text_rect to be used in get_filter_result

**Parameters** **image** (*numpy array (opencv)*) – input image from which needs to be cropped

### Image Features for Smart Cropping

#### Katna.image_features.feature

**class** Katna.image_features.feature.**Feature**(*weight*)
Bases: object

Base Class: Base class for all Image features: To be used for Katna crop rectangle scoring, all image features inherit from this base class

**get_weight**()
gets weight of particular feature

**Returns** weight of the feature

**Return type** float

#### Katna.image_features.edge_feature

**class** Katna.image_features.edge_feature.**EdgeFeature**(*weight=0.0*)
Bases: Katna.image_features.feature.Feature

Class for getting edge detector Feature, Constructor Parameters:- feature weight

Internal Parameters:-

min_val_threshold : min edge threshold

max_val_threshold : max edge threshold

ksize: size of Sobel kernel used for finding image gradients

**get_feature_map**(*image*)
Public function for getting Feature map image from edges detection

**Parameters** **image** (*numpy array*) – input image

**Returns** single channel opencv numpy image with feature map from edge detection

**Return type** numpy array

### Katna.image_features.saliency_feature

**class** Katna.image_features.saliency_feature.**SaliencyFeature**(*weight=0.0*)
Bases: Katna.image_features.feature.Feature

Class for calculating saliency feature map from Input image

**get_feature_map**(*image*)
Public function for getting Feature map image from Image saliency detection

**Parameters** **image** (*numpy array*) – input image

**Returns** single channel opencv numpy image with feature map from saliency detection

**Return type** numpy array

### Katna.image_features.face_feature

**class** Katna.image_features.face_feature.**FaceFeature**(*weight=1.0*)
Bases: Katna.image_features.feature.Feature

Class for calculating Face detection feature map from input image

Internal Parameters

model_file : Path for downloading model for face detection

prototxt_file : Path for downloading model description prototxt file

confidence : Face detection confidence threshold value

Constructor for this class does following tasks, if not already downloaded , it first downloads face detector model file and prototxt file from public URL ands save it at USER_HOME/.katna directory, or /tmp/.katna directory. After this initializer code initializes internal parameter: min_confidence (for face detection)

**download_model**()
Public function for downloading the network weight from the URL link, to be used for face detection functionality. Troubleshooting tip: If you get FileNotFound error during face detector initialization, initialize the face detector and call this function directly to download the model file from public URL link.

**download_proto**()
Public function for downloading the network weight from the URL link, to be used for face detection functionality. Troubleshooting tip: If you get FileNotFound error during face detector initialization, initialize the face detector and call this function directly to download the model file from public URL link.

**get_feature_map**(*image*)
Public function for getting Feature map image from Face detection in input Image

**Parameters** **image** (*numpy array*) – input image

**Returns** single channel opencv numpy image with feature map from Face detection

**Return type** numpy array

CHAPTER 3

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