Rolling Can Project

Programming Plan

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Programming with a Purpose
Period 4

Description:

Create a Python script using OpenCV to identify a rolling can. This script will be given a video of a can rolling in front of a camera and will need to mark the center as well as the outline of the can. Output is expected to be a video with said markings.

What I Know:

- Algorithms
  - Hough Circles
  - Hough transform
- Image operations
  - Creating image object
  - Greyscaling
  - Rescaling
  - Gaussian Blur
  - Display image object
- Drawing on image
  - Drawing dots
  - Drawing circles

What I Assume:

- Inputs
  - Video is clear
  - The camera has decent quality
  - Can does not have motion blur
  - The camera will be parallel to the face of the can
  - The video is not corrupted
- Algorithm
  - Video is able to be discreetly split into frames
  - Hough circles will work on can
- Output
  - Opencv can output videos
  - Opencv can draw on videos

What I Don't Know:

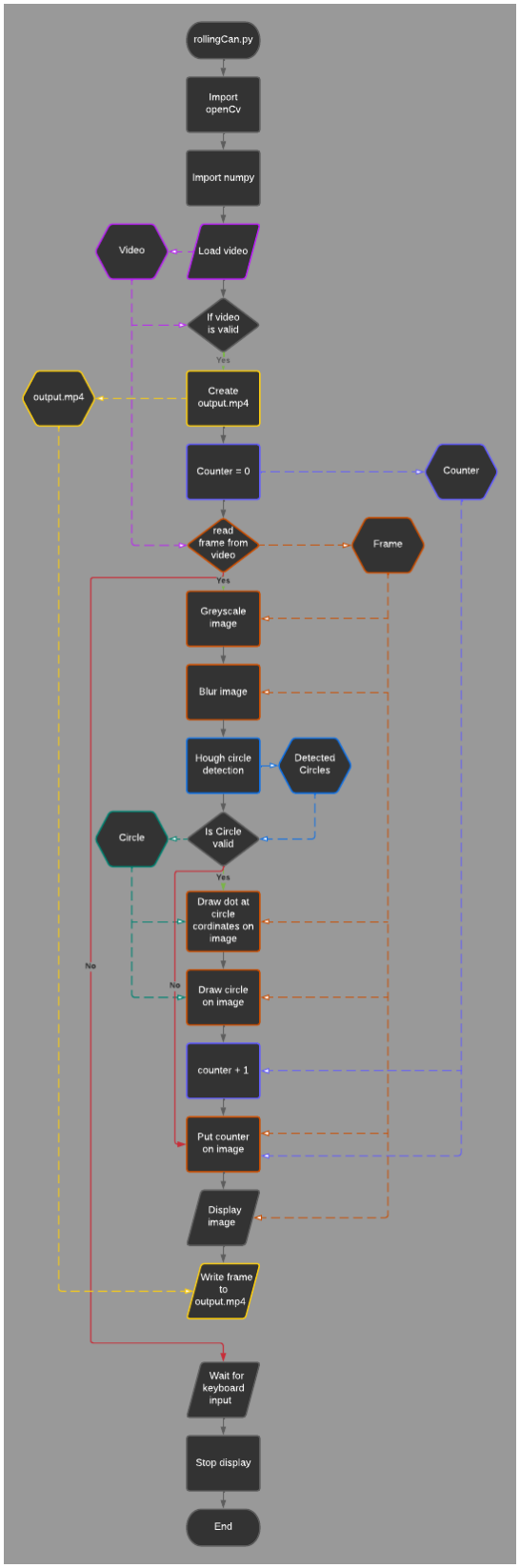
- Inputs
  - How to load video
  - How to store video in class
- Algorithm
  - How to split up video into discrete frames
- Output
  - How to display videos
  - How to draw on videos

Pseudocode:

Main.py

1. Import OpenCV library
2. Load video into class "sourceVideo"
3. For each sourceFrame in sourceVideo:
   a. Clone sourceFrame to "cvFrame"
   b. Greyscale cvFrame
   c. Blur cvFrame
   d. Run Hough transform on cvFrame to detect circles
   e. Store x y coordinates and radius
   f. Draw a dot at found x y coordinates on sourceFrame
   g. Draw a circle at found x y coordinates with radius as radius on sourceFrame
   h. Display sourceFrame

Flowchart:


rollingCan.py
Import openCv
Import numpy
Video
Load video
If video is valid
Yes
output.mp4
Create output.mp4
Counter = 0
Counter
read frame from video
Frame
Yes
Greyscale image
Blur image
Hough circle detection
Detected Circles
Circle
Is Circle valid
Yes
Draw dot at circle cordinates on image
No
Draw circle on image
counter + 1
Put counter on image
Display image
Write frame to output.mp4
No
Wait for keyboard input
Stop display
End

Test Cases:

Development phase	Test Objectives	Steps		Expected Result	Actual Result	Reasoning
Setting up development environment	OpenCV is properly installed on machine	Create new project on Pycharms	☑	New empty Pycharms window	New empty Pycharms window	N/A
		Run in python console “Import cv2”	☑	No output on console	No output on console	N/A
	OpenCV can load video	Run in python console “Import cv2”	☑	No console output	No console output	N/A
		Run in python console “video = cv2.VideoCapture(“video.mp4)”	☑	No console output	No console output	N/A
		Run in python console “video.isOpened()”	☑	Console print “True”	Console print “True”	N/A
Testing output	Display video using OpenCV	Run video loading and visualization code	☑	OpenCV window with video displaying	OpenCV window with video displaying	N/A
	Drawing dot	Run visualization code with dot draw at center	☑	OpenCV video displaying dot in center	OpenCV video displaying dot in center	N/A
	Drawing circle	Run visualization code with circle draw at center	☑	OpenCV video displaying circle in center	OpenCV video displaying circle in center	N/A

Development phase	Test Objectives	Steps		Expected Result	Actual Result	Reasoning
Testing image manipulation	Blur image	Run visualization code with blur	☑	OpenCV displaying blurred video	OpenCV displaying blurred video	N/A
	Grayscale image	Run visualization code with Greyscale	☑	OpenCV displaying Grayscale video	OpenCV displaying Grayscale video	N/A
Testing algorithm	Hough Circles	Run Hough Circle detection code on ~~first~~ 50th frame	☑	Console outputs x, y, and radius.	No circle detected on first frame	can not in the frame
					No circle was detected on 50th frame	Hough circle parameters wrong
					No circle was detected	Hough circle parameters wrong
					Unreasonable x, y, radius returned	Incorrect hough circle parameters, close enough to move to next stage
		Run Hough Circle detection code with visualization code drawing a dot on first frame	☐	Console outputs dot at the center of can	On the 50th frame, false circle detected	Incorrect hough circle parameters, too much blur
					On the 50th frame, false circle detected	Incorrect hough circle parameters
					On 50th frame, dot off-center	Incorrect hough circle parameters
					On 50th frame, dot near center	Close enough to move to next stage
		Run Hough Circle detection code for each frame of the video	☐	Console outputs x, y, and radius for each frame	Code crashes with object “None” is not subscriptable	Does not handle failure to detect circle
					Program runs extremely slow	Resolution too high
					Dot is drawn near center, but radius	Incorrect hough circle parameters

Development phase	Test Objectives	Steps		Expected Result	Actual Result	Reasoning
					fluctuates a lot; Console outputs x, y, and radius for each frame	
		Run Hough Circle detection code with visualization code	☑	Console outputs video with dot and circle traveling	Outputs video with dot and circle jittering outside and inside of can	Max and min radius need to be tweaked
					Outputs video with dot and circle around outside of can	Max radius is too high
					Outputs video with dot and circle around inner ring of can	Max radius is too low; minimum radius too low
					Console outputs video with dot and circle around inner ring of can	minimum radius too low
					Console outputs video without circle	Max radius is too low; minimum radius too high
					Outputs video with dot and circle accurate	N/A
Perfecting accuracy	Displaying text	Displaying detected frames and total frames		Text displayed on frames	Outputs video with counter	N/A
		Displaying outline	☑	Text is outlined	Outline color overrides counter color	Draws outline after counter
					Outputs counter with outline	N/A
	Tuning algorithm	Hough Circles	☑	More frames detected	Detects more partial circle frames; very	Lower param2

Development phase	Test Objectives	Steps		Expected Result	Actual Result	Reasoning
					jittery	
				Less jitter	Jitter decreased	Max and min adjust
Saving Video	Writing video	Write Video	☑	Video saved as “output.mp4”	Output cannot be opened	Wrong codec
					Output shows working video	N/A