self work

July 10, 2022

[ ]:

```
import matplotlib.image as mpimg
import matplotlib.pyplot as plt
import numpy as np
import cv2
```

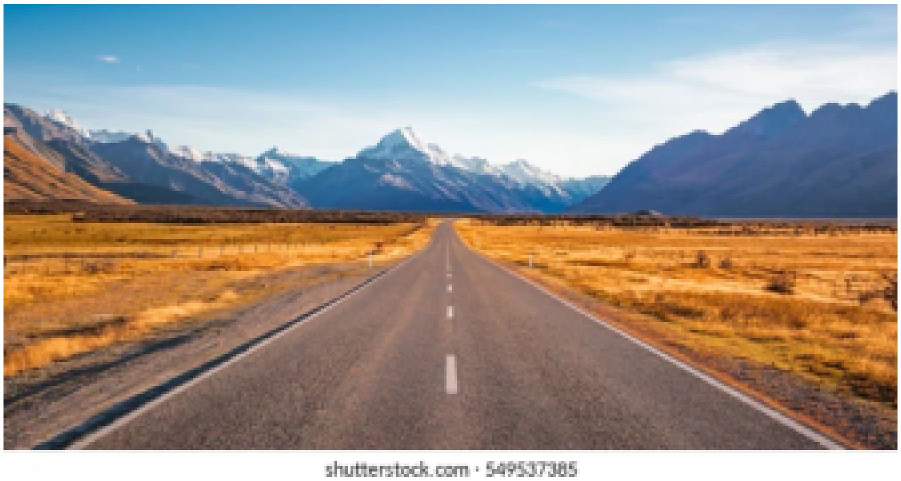
1 Import image with road line

[ ]:

```
image = cv2.imread("road_testing.jpg")
#cv2.imshow("input_image", image)

lanelines_image = np.copy(image)

plt.axis("off")
plt.imshow(cv2.cvtColor(lanelines_image, cv2.COLOR_BGR2RGB))
plt.show()
```



2 Pre-process the image

2.1 1)Turn the image to gray

2.2 2)blury the image

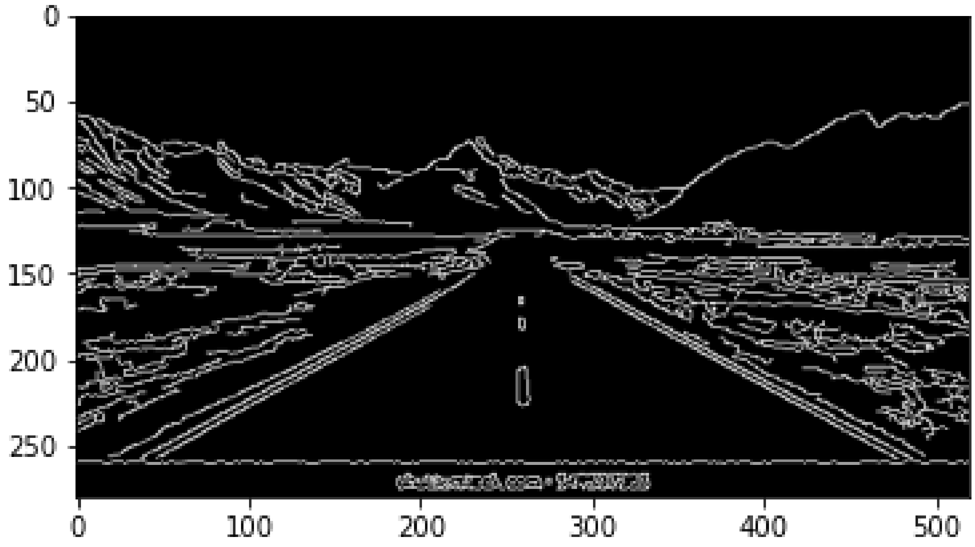
2.3 3)Applied canny edge detection

[ ]:

```
# Use canny_edge to detect of edge in the image
def canny_edge(image):
    lanelines_image = np.copy(image)
    gray_conversion = cv2.cvtColor(lanelines_image, cv2.COLOR_RGB2GRAY)
    blur_conversion = cv2.GaussianBlur(gray_conversion, (5,5), 0)
    canny_conversion = cv2.Canny(blur_conversion, 50, 150)

    return canny_conversion

canny_image = canny_edge(lanelines_image)
plt.imshow(cv2.cvtColor(canny_image, cv2.COLOR_BGR2RGB))
plt.show()
```



[ ]:

```
image.shape
```

[ ]:

```
(280, 520, 3)
```

3 Masking the region of interest

1) Select the road line region
   In this case, we use (200, Image_height), (1100, Image_height), (551, 250)

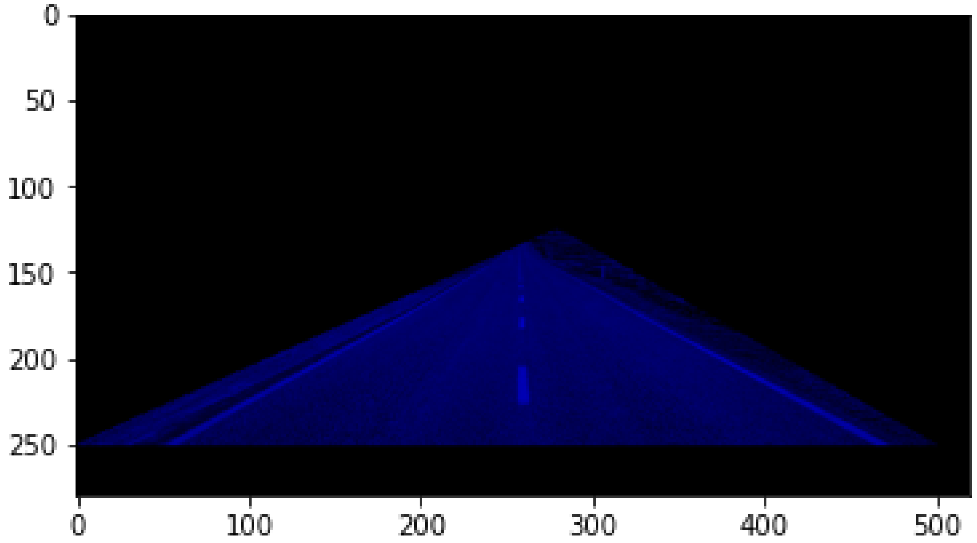
[ ]:

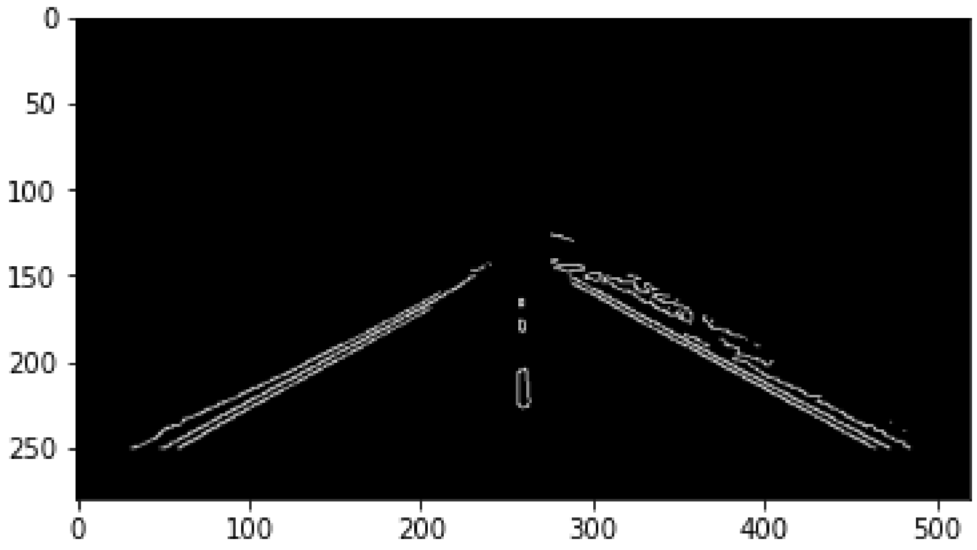
```
#choose the region of intereset
def reg_of_interest(image):
    Image_height = image.shape[0]
    polygons = np.array([[(0, Image_height-30), (500, Image_height-30), (280, 125)]])

    image_mask = np.zeros_like(image)
    cv2.fillPoly(image_mask, polygons, 255)
    masking_image = cv2.bitwise_and(image, image_mask)
    return masking_image

display_image = reg_of_interest(lanelines_image)
plt.imshow(cv2.cvtColor(display_image, cv2.COLOR_BGR2RGB))
plt.show()

cropped_image = reg_of_interest(canny_image)
plt.imshow(cv2.cvtColor(cropped_image, cv2.COLOR_BGR2RGB))
plt.show()
```





4 Applying the Hough transform on interest region

[ ]:

```
lane_lines = cv2.HoughLinesP(cropped_image, 2, np.pi / 180, 150, None, 0, 0)
```

5 Display the line in image

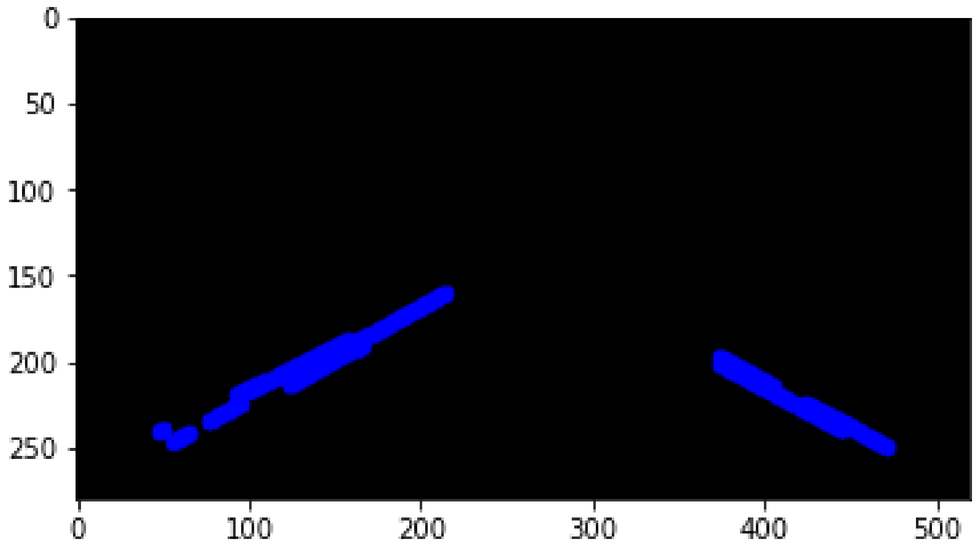
[ ]:

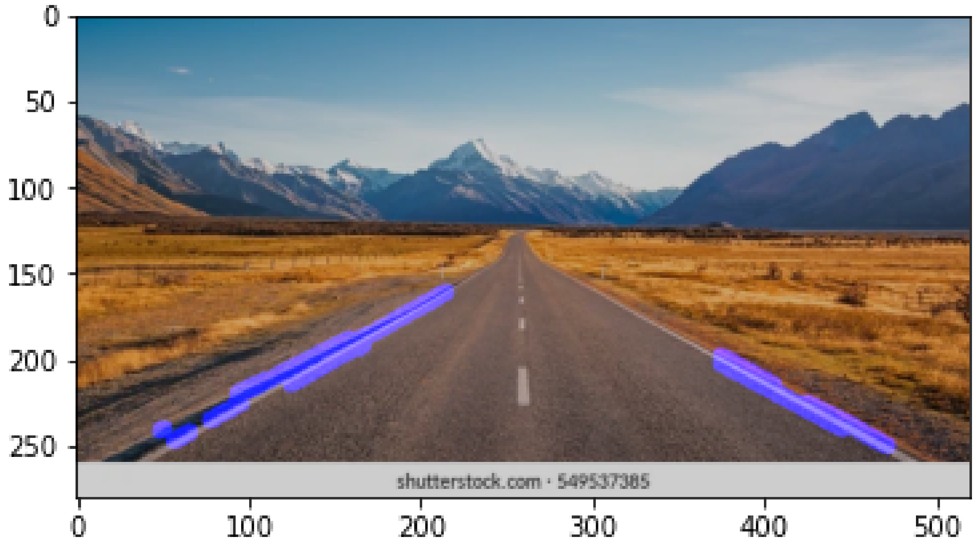
```
# function to display the line
def show_lines(image, lines):
    lines_image = np.zeros_like(image)
    if lines is not None:
        for line in lines:
             X1, Y1, X2, Y2 = line.reshape(4)
             cv2.line(lines_image, (X1, Y1), (X2, Y2), (255, 0, 0), 10)
    return lines_image
```

[ ]:

```
draft_image = show_lines(lanelines_image, lane_lines)
plt.imshow(cv2.cvtColor(draft_image, cv2.COLOR_BGR2RGB))
plt.show()


combine_image = cv2.addWeighted(lanelines_image, 0.8, draft_image, 1, 1)
plt.imshow(cv2.cvtColor(combine_image, cv2.COLOR_BGR2RGB))
plt.show()
```





6 Optimizing the dected road markings

[ ]:

```
def make_coordinates(image, line_parameters):
    try:
        slope, intercept = line_parameters
    except TypeError:
        slope, intercept = 0.001,0
          #slope, intercept = line_parameters
    y1 = image.shape[0]
    y2 = int((y1 * (3/5)))
    x1 = int((y1 - intercept) / slope)
    x2 = int((y2 - intercept) / slope)
    return np.array([x1, y1, x2, y2])
```

[ ]:

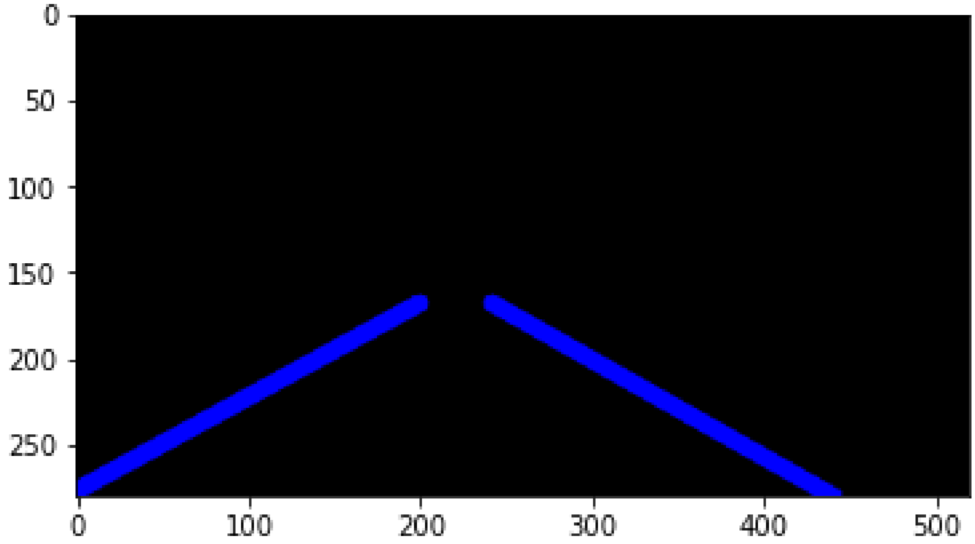
```
def average_slope_intercept(image, lines):
    left_fit = []
    right_fit = []
    for line in lines:
        x1, y1, x2, y2 = line.reshape(4)
        parameter = np.polyfit((x1, x2), (y1, y2), 1)
        slope = parameter[0]
        intercept = parameter[1]
        if slope < 0:
            left_fit.append((slope, intercept))
        else:
            right_fit.append((slope, intercept))
    left_fit_average = np.average(left_fit, axis=0)
    right_fit_average = np.average(right_fit, axis = 0)
    left_line = make_coordinates(image, left_fit_average)
    right_line = make_coordinates(image, right_fit_average)
    return np.array([left_line, right_line])
```

[ ]:

```
averaged_lines = average_slope_intercept(lanelines_image, lane_lines)
line_image = show_lines(lanelines_image, averaged_lines)

plt.imshow(cv2.cvtColor(line_image, cv2.COLOR_BGR2RGB))
plt.show()
```

```
/var/folders/wj/2bdfjxmx6_dd5gvnsyg6_rvc0000gn/T/ipykernel_4889/1629898443.py:1:
RankWarning: Polyfit may be poorly conditioned
  averaged_lines = average_slope_intercept(lanelines_image, lane_lines)
/var/folders/wj/2bdfjxmx6_dd5gvnsyg6_rvc0000gn/T/ipykernel_4889/1629898443.py:1:
RankWarning: Polyfit may be poorly conditioned
  averaged_lines = average_slope_intercept(lanelines_image, lane_lines)
```

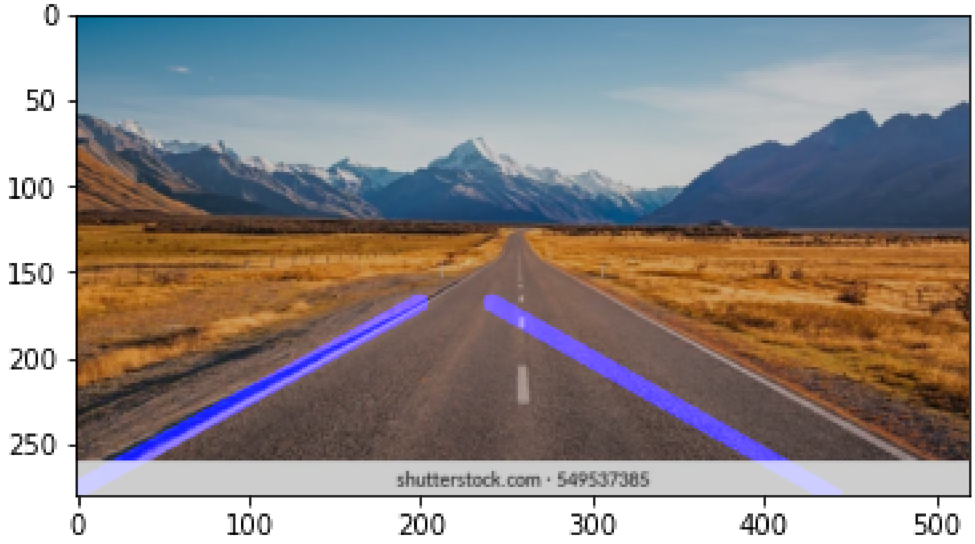


7 Display the full output

[ ]:

```
#lanelines_image is the copy of origin
combine_image = cv2.addWeighted(lanelines_image, 0.8, line_image, 1, 1)

plt.imshow(cv2.cvtColor(combine_image, cv2.COLOR_BGR2RGB))
plt.show()
```



8 Line dected on video

unblock to play the video, click q to quiet video

[ ]:
```
#cap = cv2.VideoCapture("test2.mp4")
```

[ ]:
```
"""
while(cap.isOpened()):
            _, frame = cap.read()
            canny_image = canny_edge(frame)
            cropped_canny = reg_of_interest(canny_image)
            lines = cv2.HoughLinesP(cropped_canny, 2, np.pi/180, 100, ␣
 ↪ np.array([]), minLineLength=40,maxLineGap=5)
            averaged_lines = average_slope_intercept(frame, lines)
            line_image = show_lines(frame, averaged_lines)
            combo_image = cv2.addWeighted(frame, 0.8, line_image, 1, 1)
            cv2.imshow("result", combo_image)
            if cv2.waitKey(1) & 0xFF == ord('q'):
                break
cap.release()
cv2.waitKey(0)
cv2.destroyAllWindows()
"""
```

[ ]:
```
'\nwhile(cap.isOpened()):\n            _, frame = cap.read()\n
canny_image = canny_edge(frame)\n            cropped_canny =
reg_of_interest(canny_image)\n            lines = cv2.HoughLinesP(cropped_canny,
2, np.pi/180, 100,             np.array([]), minLineLength=40,maxLineGap=5)\n
averaged_lines = average_slope_intercept(frame, lines)\n            line_image =
show_lines(frame, averaged_lines)\n            combo_image =
cv2.addWeighted(frame, 0.8, line_image, 1, 1)\n            cv2.imshow("result",
combo_image)\n            if cv2.waitKey(1) & 0xFF == ord(\'q\'):\n
break\ncap.release()\ncv2.waitKey(0)\ncv2.destroyAllWindows()\n'
```