In [1]:
```
from PIL import Image
import cv2
import numpy as np
import requests
```

Reading image from URL

In [2]:
```
image = Image.open(requests.get('https://media.wired.com/photos/5dae3adbd08f8f00081214a4/master/pass/Biz-Polestar
image = image.resize((350,225))
image_arr = np.array(image)
image
```

Out[2]:

Grayscale Image

In [3]:
```
grey = cv2.cvtColor(image_arr,cv2.COLOR_BGR2GRAY)
Image.fromarray(grey)
```

Out[3]:

Gaussian Blur

In [4]:
```
blur = cv2.GaussianBlur(grey,(5,5),0)
Image.fromarray(blur)
```

Out[4]:

Dilation

In [5]:
```
dilated = cv2.dilate(blur,np.ones((3,3)))
Image.fromarray(dilated)
```

Out[5]:

Morphology-Ex, structuring element

In [6]:
```
kernel = cv2.getStructuringElement(cv2.MORPH_ELLIPSE, (2, 2))
closing = cv2.morphologyEx(dilated, cv2.MORPH_CLOSE, kernel)
Image.fromarray(closing)
```

Out[6]:

In [7]:
```
car_cascade_src = 'cars.xml'
car_cascade = cv2.CascadeClassifier(car_cascade_src)
cars = car_cascade.detectMultiScale(closing, 1.1, 1)
cars
```

Out[7]:
```
array([[124, 111,  74,  74]])
```

In [8]:
```
cnt = 0
for (x,y,w,h) in cars:
    cv2.rectangle(image_arr,(x,y),(x+w,y+h),(255,0,0),2)
    cnt += 1
print(cnt, " cars found")
Image.fromarray(image_arr)
```

```
1  cars found
```

Out[8]:

Reading image from URL

In [9]:
```
image = Image.open(requests.get('https://i.ytimg.com/vi/AkLfPjxlyfw/maxresdefault.jpg', stream=True).raw)
image = image.resize((350,225))
image_arr = np.array(image)
image
```

Out[9]:

In [10]:
```
grey = cv2.cvtColor(image_arr,cv2.COLOR_BGR2GRAY)
Image.fromarray(grey)
```

Out[10]:

In [11]:
```
 blur = cv2.GaussianBlur(grey,(5,5),0)
Image.fromarray(blur)
```

Out[11]:

In [12]:
```
dilated = cv2.dilate(blur,np.ones((3,3)))
Image.fromarray(dilated)
```

Out[12]:

In [13]:
```
kernel = cv2.getStructuringElement(cv2.MORPH_ELLIPSE, (2, 2))
closing = cv2.morphologyEx(dilated, cv2.MORPH_CLOSE, kernel)
```

```
Image.fromarray(closing)
```

Out[13]:

In [14]:

```
car_cascade_src = 'Bus_front.xml'
car_cascade = cv2.CascadeClassifier(car_cascade_src)
cars = car_cascade.detectMultiScale(closing, 1.1, 1)
cars
```

Out[14]:

```
array([[144,  48,  86,  86]])
```

In [15]:

```
cnt = 0
for (x,y,w,h) in cars:
    cv2.rectangle(image_arr,(x,y),(x+w,y+h),(255,0,0),2)
    cnt += 1
print(cnt, " cars found")
Image.fromarray(image_arr)
```

```
1  cars found
```

Out[15]:

In [16]:

```
import numpy as np
import cv2
```

In [17]:

```
car_cascade = cv2.CascadeClassifier('cars.xml')
```

In [18]:

```
vc = cv2.VideoCapture('video2.avi')

if vc.isOpened():
    rval , frame = vc.read()
else:
    rval = False
    print('Video Not Found')
```

In [19]:

```
rectangles = []
while rval:
    rval, frame = vc.read()
    frameHeight, frameWidth, fdepth = frame.shape
    frame = cv2.resize(frame, ( 600,  400 ))
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    cars = car_cascade.detectMultiScale(gray, 1.2, 2)

    for (x, y, w, h) in cars:
        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 0, 255), 2)

    cv2.imshow("Result",frame)

    if cv2.waitKey(33) == ord('q'):
```

```
        break
vc.release()
cv2.destroyAllWindows()
```

In [20]:

```
import numpy as np
import cv2

car_cascade = cv2.CascadeClassifier('cars.xml')

vc = cv2.VideoCapture('video1.avi')

if vc.isOpened():
    rval , frame = vc.read()
else:
    rval = False
    print('Video Not Found')

rectangles = []
while rval:
    rval, frame = vc.read()
    frameHeight, frameWidth, fdepth = frame.shape
    frame = cv2.resize(frame, ( 600,  400 ))
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    cars = car_cascade.detectMultiScale(gray, 1.2, 2)

    for (x, y, w, h) in cars:
        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 0, 255), 2)

    cv2.imshow("Result",frame)

    if cv2.waitKey(33) == ord('q'):
        break
vc.release()
cv2.destroyAllWindows()
```

In [21]:

```
import numpy as np
import cv2

car_cascade = cv2.CascadeClassifier('cars.xml')
Bus_cascade = cv2.CascadeClassifier('Bus_front.xml')

vc = cv2.VideoCapture('Cars_On_Highway.mp4')


if vc.isOpened():
    rval , frame = vc.read()
else:
    rval = False
    print('Video Not Found')

rectangles = []
while rval:
    rval, frame = vc.read()
    frameHeight, frameWidth, fdepth = frame.shape
    frame = cv2.resize(frame, ( 600,  400 ))
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    cars = car_cascade.detectMultiScale(gray, 1.2, 2)

    for (x, y, w, h) in cars:
        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 0, 255), 2)

    cv2.imshow("Result",frame)

    if cv2.waitKey(33) == ord('q'):
        break
vc.release()
cv2.destroyAllWindows()
```

In [ ]: