AI VIETNAM
AI Insight Course

Object Tracking Using Pretrained Model

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Ph.D. in Computer Science

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Hệ số tương quan (correlation coefficient)

Công thức: Gọi x,y là hai biến ngẫu nhiên

$$\rho_{xy} = \frac{E[(x-\mu_x)[(y-\mu_y)]}{\sqrt{var(x)}\sqrt{var(y)}}$$

$$= \frac{n(\sum_i x_i y_i) - (\sum_i x_i)(\sum_i y_i)}{\sqrt{n\sum_i x_i^2 - (\sum_i x_i)^2}\sqrt{n\sum_i y_i^2 - (\sum_i y_i)^2}}$$

Tính chất 1

$$-1 \leq \rho_{xy} \leq 1$$

Tương quan nghịch ← | → **Tương quan thuận**

Tính chất 2

$$\rho_{xy} = \rho_{uv}$$

trong đó

$$u = ax + b$$

$$v = cy + d$$

Ví dụ 1

x = [7, 18, 29, 2, 10, 9, 9]

y = [1, 6, 12, 8, 6, 21, 10]

$$\rho_{xy} = \frac{E[(x-\mu_x)[(y-\mu_y)]}{\sqrt{var(x)}\sqrt{var(y)}}$$

$$= \frac{n*818 - 84*64}{\sqrt{n*1480 - 7056}\sqrt{n*822 - 4096}} = 0.149$$

Ví dụ 2

u=2*x-14 = [0, 22, 44, -10, 6, 4, 4]

v=y+2 = [3, 8, 14, 10, 8, 23, 12]

$$\rho_{uv} = \frac{E[(u-\mu_u)[(v-\mu_v)]}{\sqrt{var(u)}\sqrt{var(v)}}$$

$$= \frac{n*880 - 70*78}{\sqrt{n*2588 - 4900}\sqrt{n*1106 - 6084}} = 0.149$$

Ứng dụng cho patch matching

P_1 P_2 P_3 P_4

$\rho_{P_1P_2} = 0.55$

$\rho_{P_1P_3} = 0.23$ ➧ Ảnh P_2 giống với ảnh P_1 hơn so với P_3 và P_4

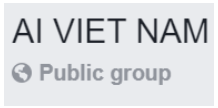
$\rho_{P_1P_4} = 0.30$

P_1 $P_2 = P_1+50$ $P_3 = 1.2P_1+10$

$\rho_{P_1P_2} = 0.9970$

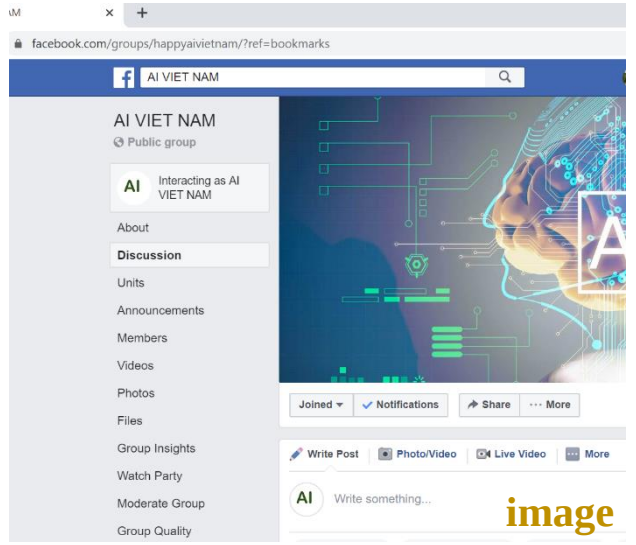
$\rho_{P_1P_3} = 0.9979$ ➧ ρ hoạt động tốt dưới sự thay đổi tuyến tính

Ứng dụng vào template matching



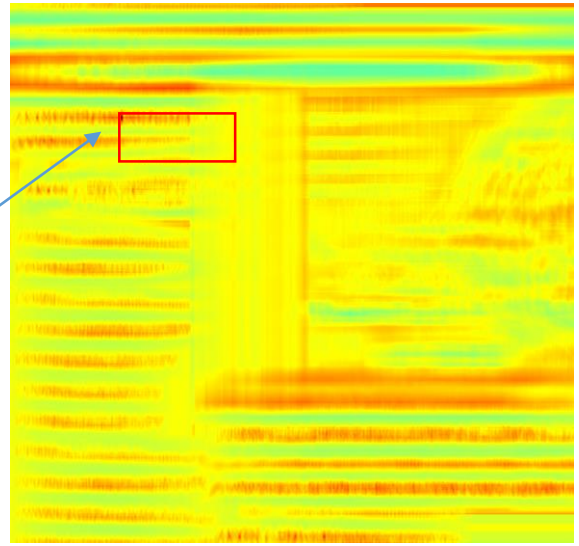
template

Tìm template có trong hình image

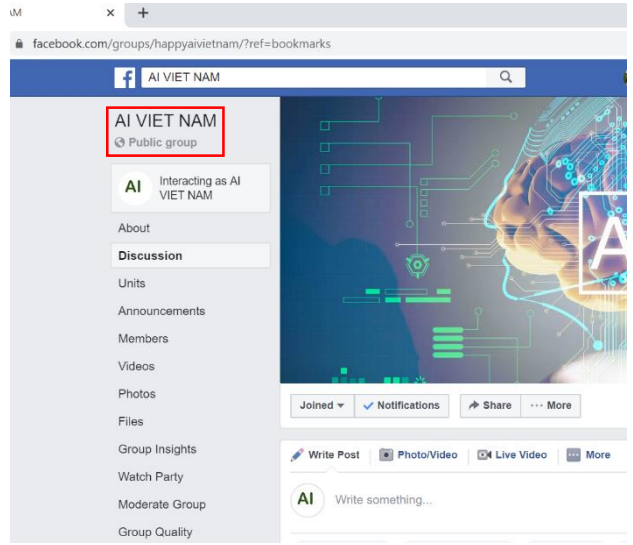


image

max



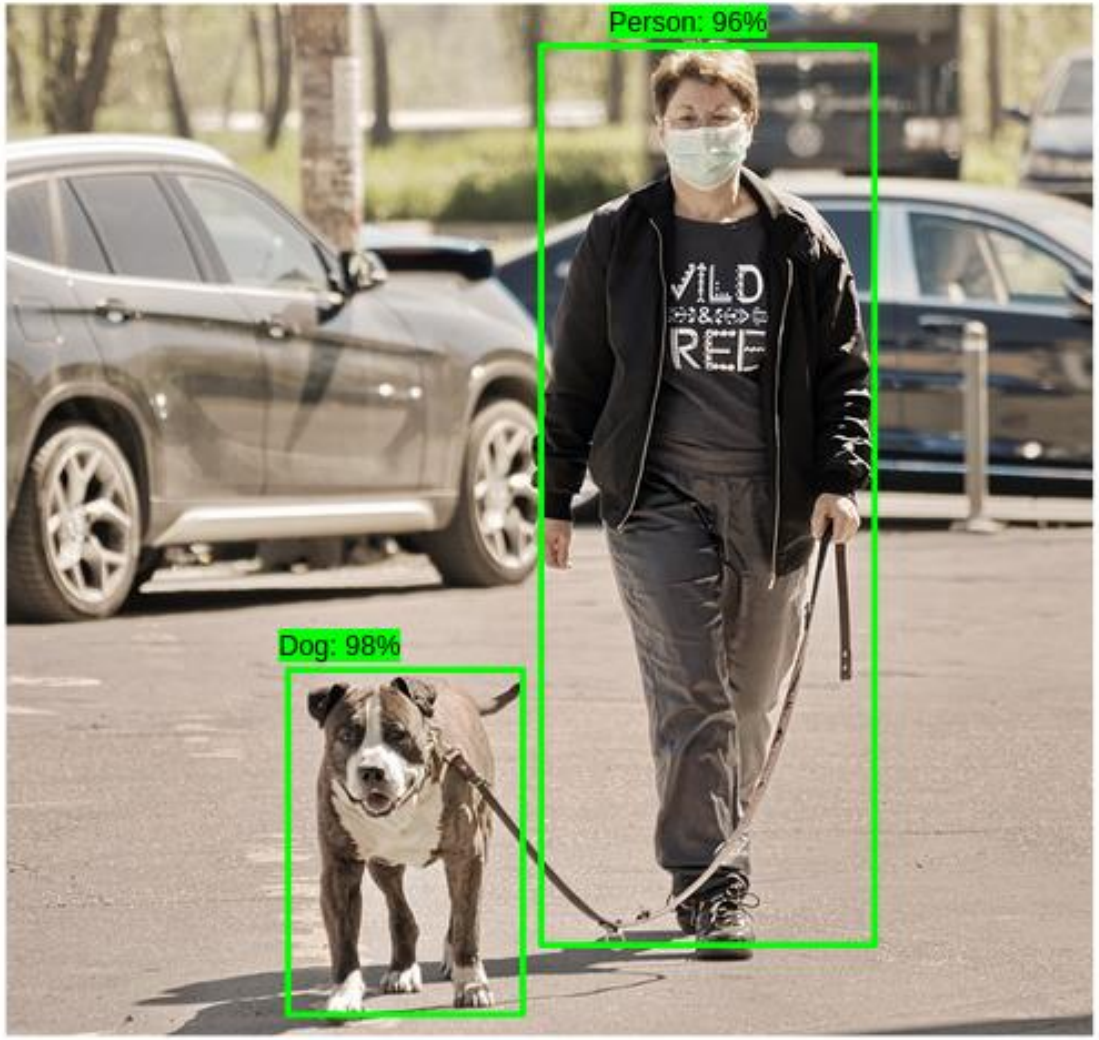
Map ρ cho từng pixel trong ảnh image



Kết quả

Naïve Object Detection

❖ Idea

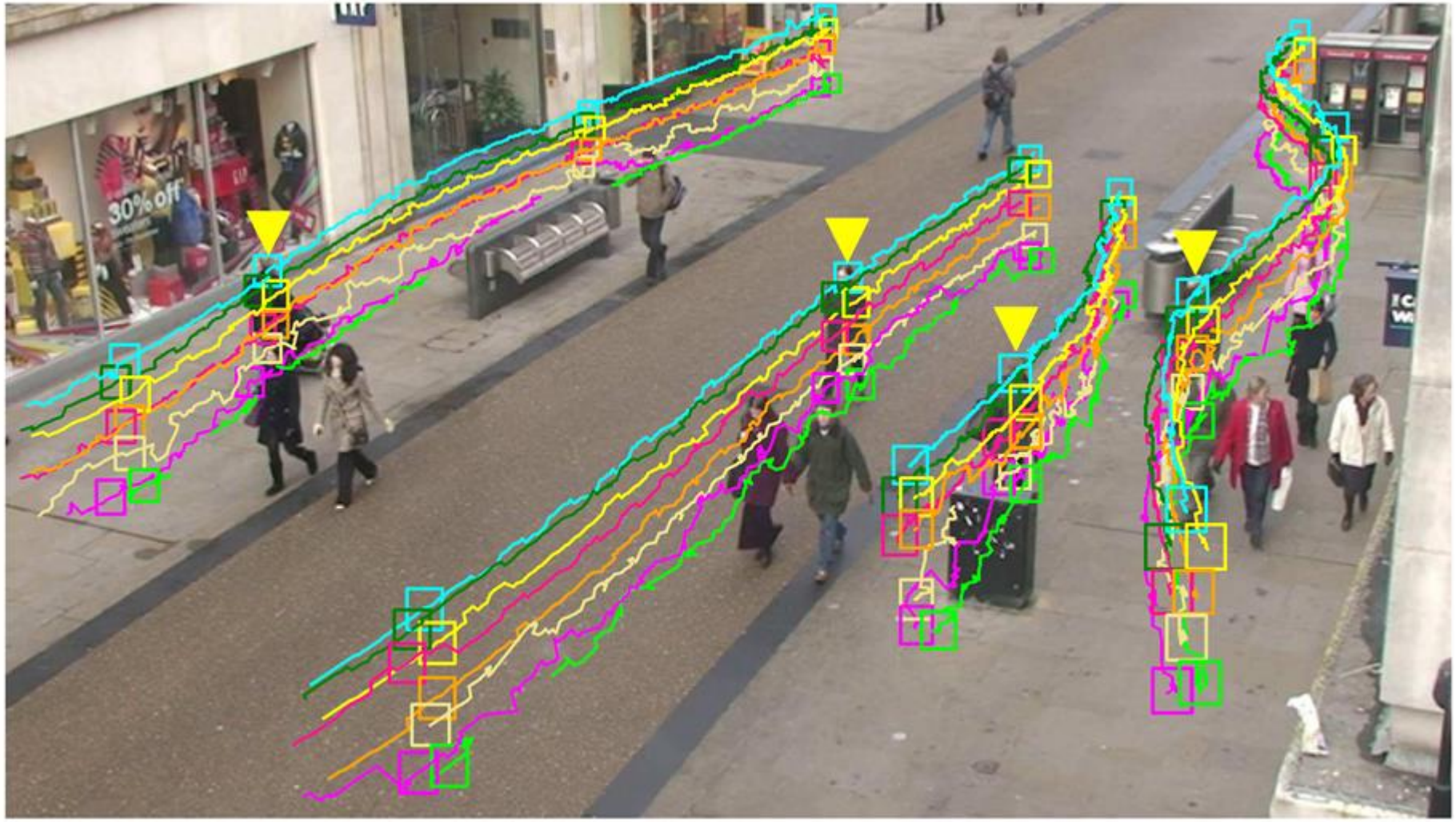


https://www.analyticsvidhya.com/blog/2020/08/selecting-the-right-bounding-box-using-non-max-suppression-with-implementation/

Object Tracking Using Pretrained Model

Object Tracking

❖ **Objective**



http://deepmachinelearningai.com/object-tracking-in-deep-learning/

Object Tracking

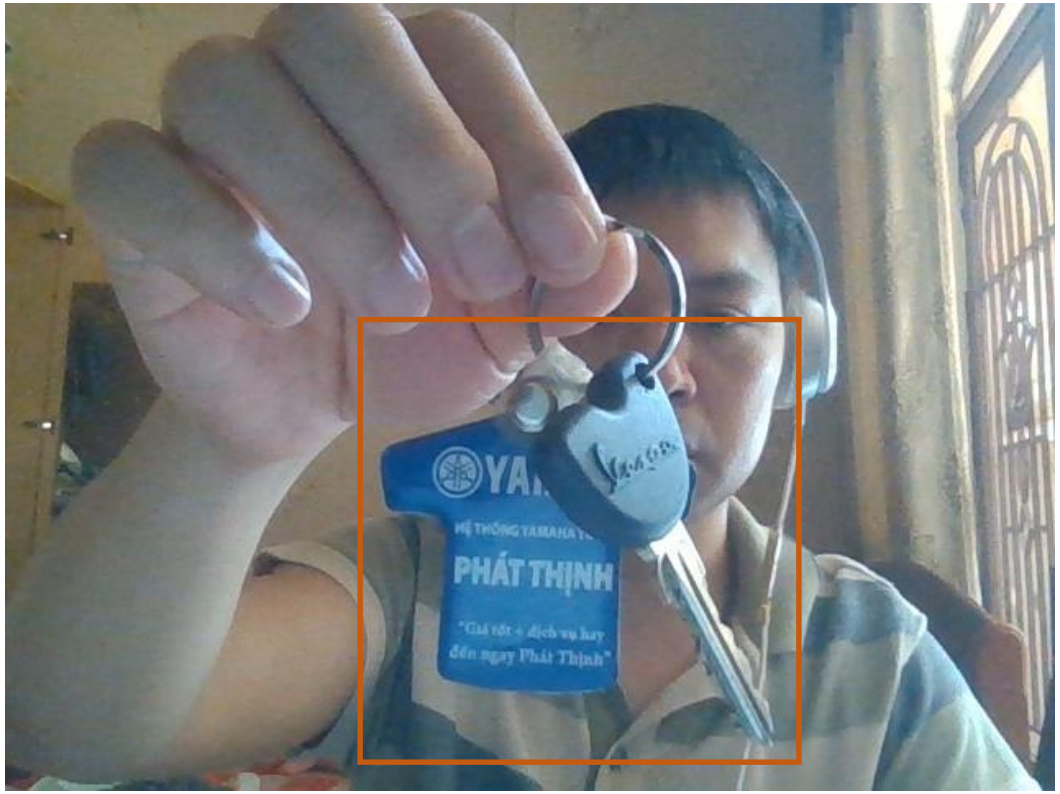
❖ Objective

Frame at time t

Frame at time k

Object Tracking

❖ Objective

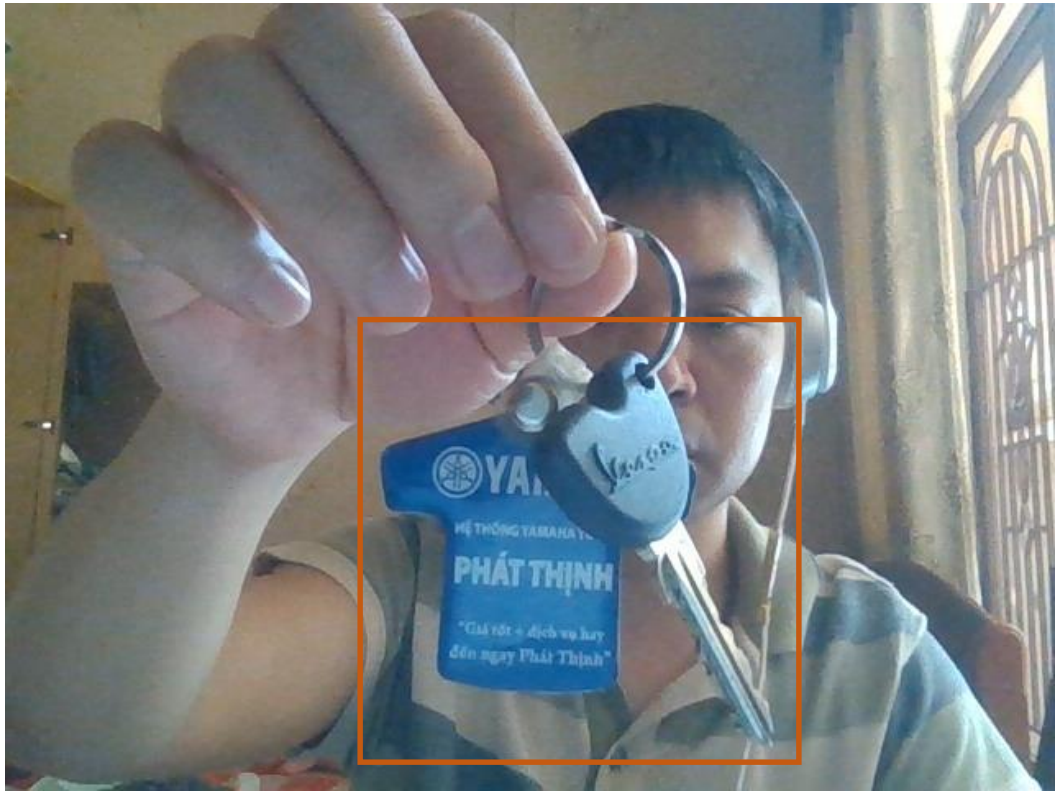


Frame at time t

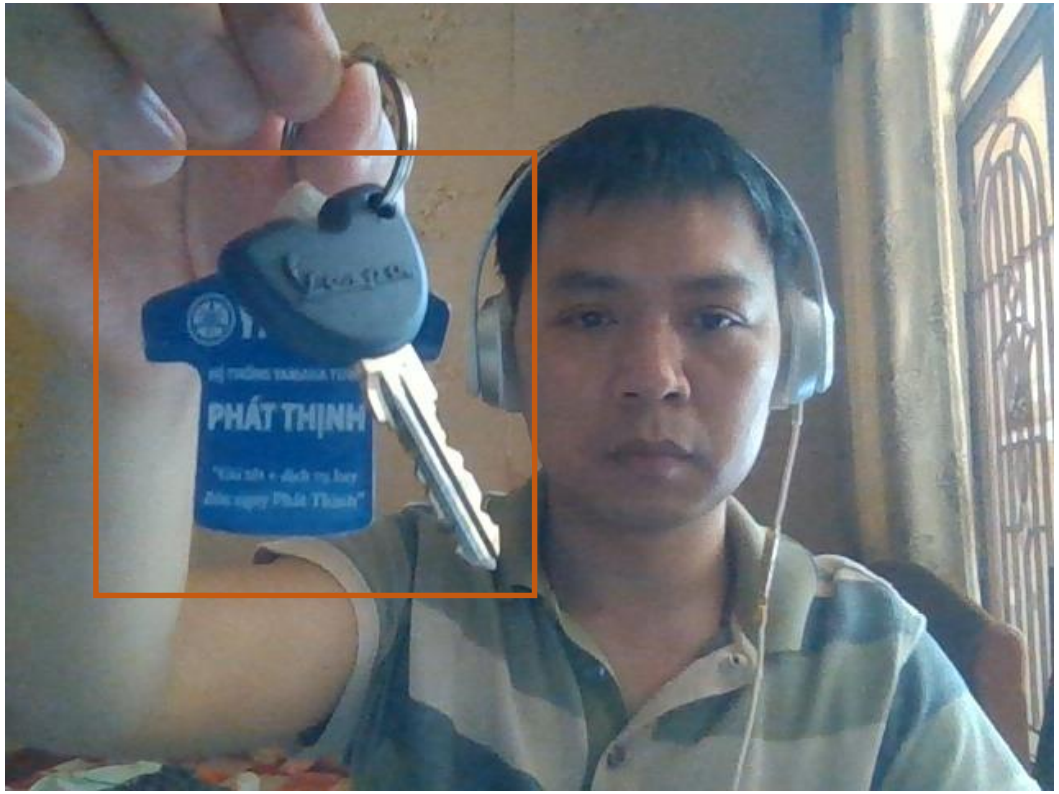
Frame at time k

Object Tracking

❖ Objective



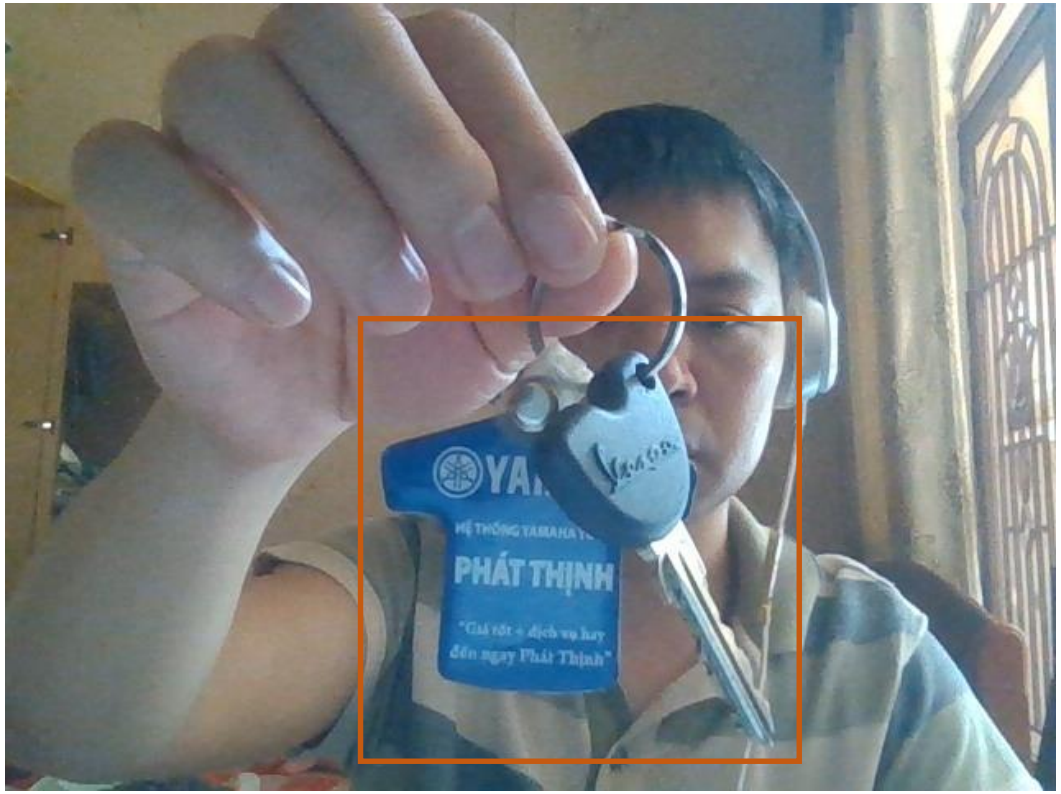
Frame at time t



Frame at time k

Object Tracking

❖ Idea



Frame at time t

Object Tracking

❖ Idea

Frame at time k

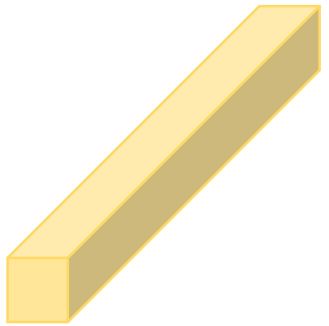
Object Tracking

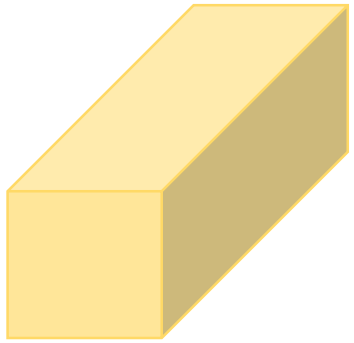
Template

Frame at time k

Feature Extraction

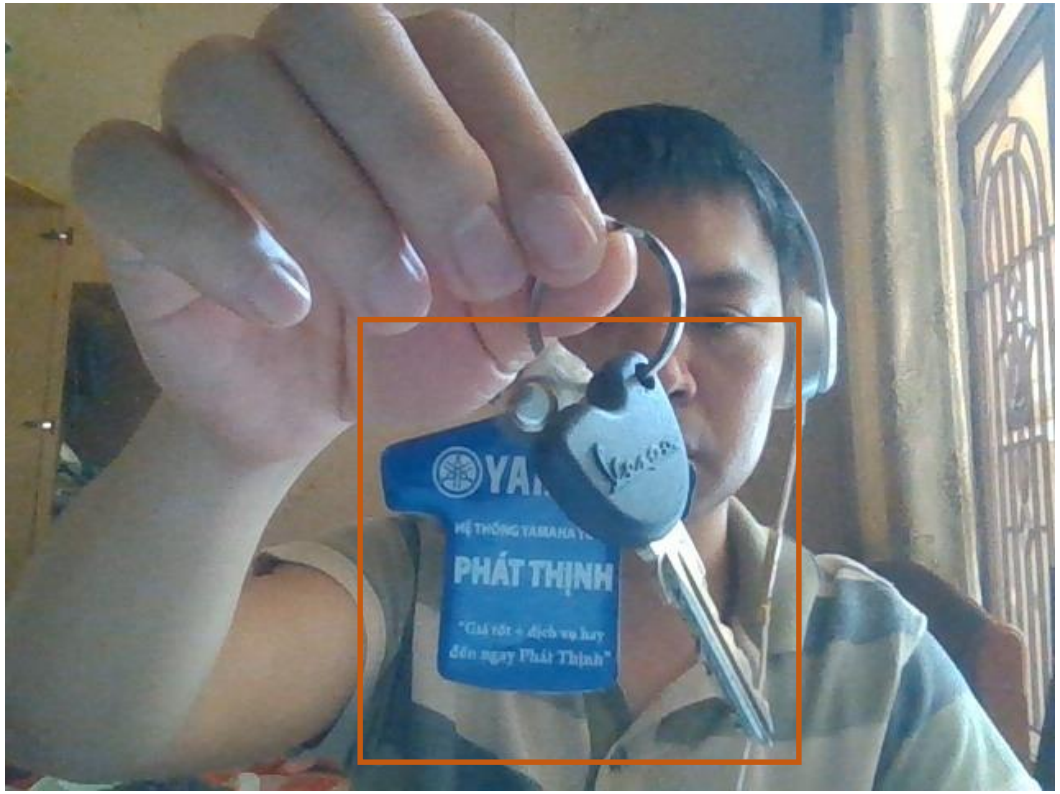
Feature Extraction





Object Tracking

❖ Case Study 1



Frame at time t

Frame at time k

Object Tracking

❖ Case Study 2: video

15.3.ObjectTracking_video2.ipynb ☆

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+ Code + Text

```
import numpy as np
from sklearn.metrics.pairwise import cosine_similarity

import tensorflow as tf
from tensorflow.keras.preprocessing import image as kimage
from tensorflow.keras.applications.vgg16 import preprocess_input

from google.colab import drive
drive.mount('/content/gdrive')
```

Object Tracking

❖ Case Study 3: video2 and video3

15.5.ObjectTracking_video3.ipynb ☆

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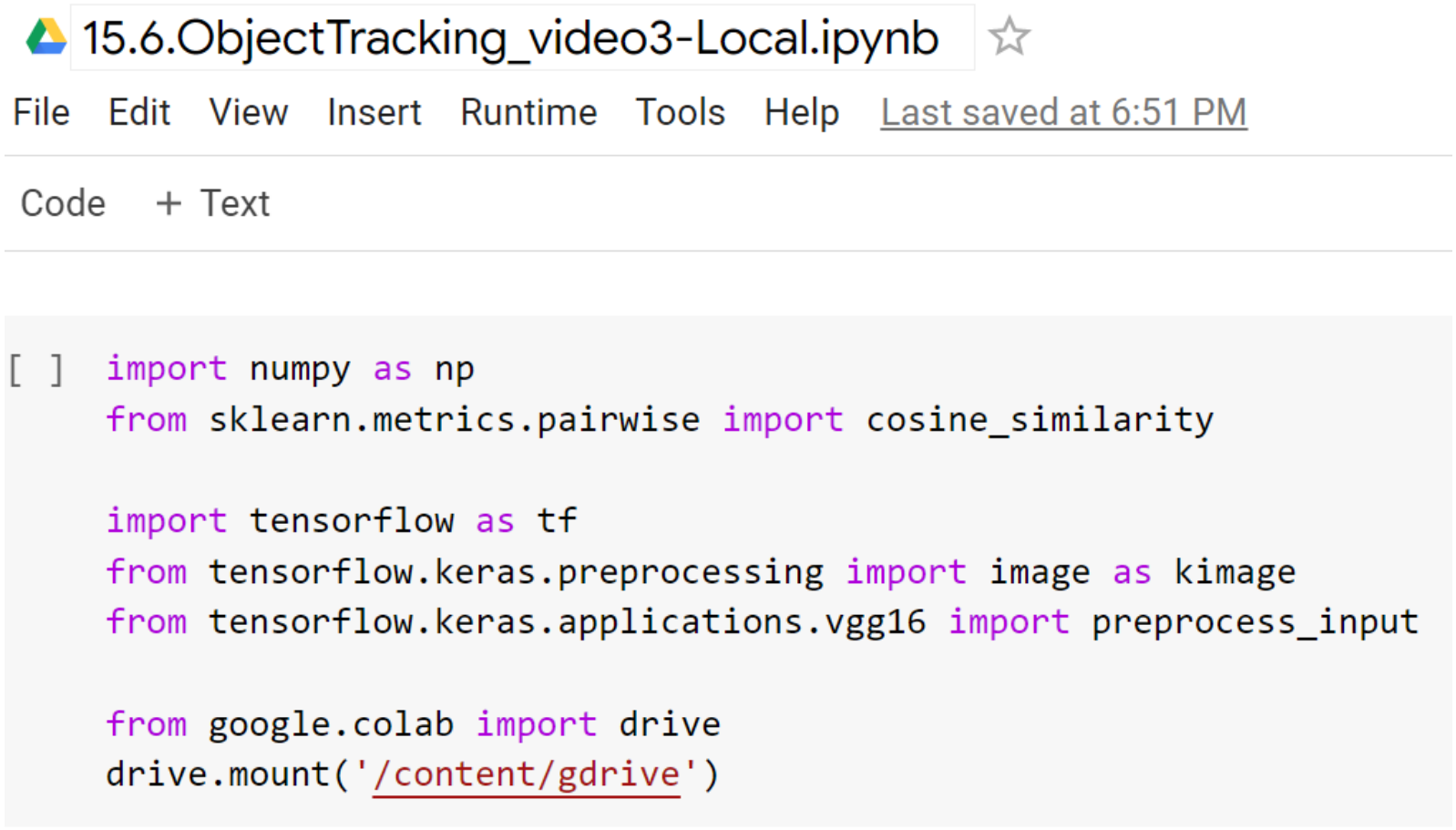
+ Code + Text

```
import numpy as np
from sklearn.metrics.pairwise import cosine_similarity

import tensorflow as tf
from tensorflow.keras.preprocessing import image as kimage
from tensorflow.keras.applications.vgg16 import preprocess_input

from google.colab import drive
drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```

Object Tracking

❖ Case Study 4: Searching locally



Object Tracking

❖ Case Study 5: Updating template

15.7.ObjectTracking_video3-Update.ipynb ☆

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Code + Text

```
import numpy as np
from sklearn.metrics.pairwise import cosine_similarity

import tensorflow as tf
from tensorflow.keras.preprocessing import image as kimage
from tensorflow.keras.applications.vgg16 import preprocess_input

from google.colab import drive
drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```

Object Tracking

❖ Case Study 6: Combination

15.8.ObjectTracking_video3-Local+Update.ipynb ☆

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Code + Text

```
[ ]  import numpy as np
     from sklearn.metrics.pairwise import cosine_similarity

     import tensorflow as tf
     from tensorflow.keras.preprocessing import image as kimage
     from tensorflow.keras.applications.vgg16 import preprocess_input

     from google.colab import drive
     drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```

Object Tracking

❖ Case Study 7: Scaling

5.9.ObjectTracking_video4.ipynb ☆

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Code + Text

```
[ ]  import numpy as np
     from sklearn.metrics.pairwise import cosine_similarity

     import tensorflow as tf
     from tensorflow.keras.preprocessing import image as kimage
     from tensorflow.keras.applications.vgg16 import preprocess_input

     from google.colab import drive
     drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```


Thank you!