

TEMPLATE MATCHING

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2425I_AIT3002#_38

1. Template Matching

Project sử dụng thuật toán template matching trong thư viện OpenCV:

cv2.TM_CCOEFF_NORMED (Normalized Cross-Correlation Coefficient) để đo lường độ tương đồng giữa mẫu và vùng trong hình ảnh bằng cách tính toán hệ số tương quan theo công thức sau:

$$R(x, y) = \frac{\sum_{x', y'} (T'(x', y') \cdot I'(x + x', y + y'))}{\sqrt{\sum_{x', y'} T'(x', y')^2 \cdot \sum_{x', y'} I'(x + x', y + y')^2}}$$

Đối với yêu cầu đếm số lượng đối tượng trong ảnh, được thực hiện thông qua hàm `counting(img, template, THRESHOLD, proximity_threshold=50)`.

Trong đó:

- `img`: biến lưu ma trận ảnh đầu vào.
- `template`: biến lưu ma trận template.
- `THRESHOLD`: biến lưu giá trị ngưỡng thỏa mãn.
- `proximity_threshold`: biến lưu giá trị ngưỡng lân cận điểm thỏa mãn

Khi thực hiện hàm, một cửa sổ kích thước tương đương với template quét qua `img`, tại vị trí nào có giá trị $R > \text{THRESHOLD}$ và tọa độ của cửa sổ trên ảnh có khoảng cách với các giá trị lân cận lớn hơn khoảng `proximity_threshold` sẽ được lưu và thể hiện bởi một hộp chữ nhật kèm với số thứ tự.

Đối với yêu cầu tìm đối tượng, được thực hiện thông qua hàm

`finding(img, template, THRESHOLD, proximity_threshold=50, scale_range=(0.5, 5.0), scale_steps=20)`

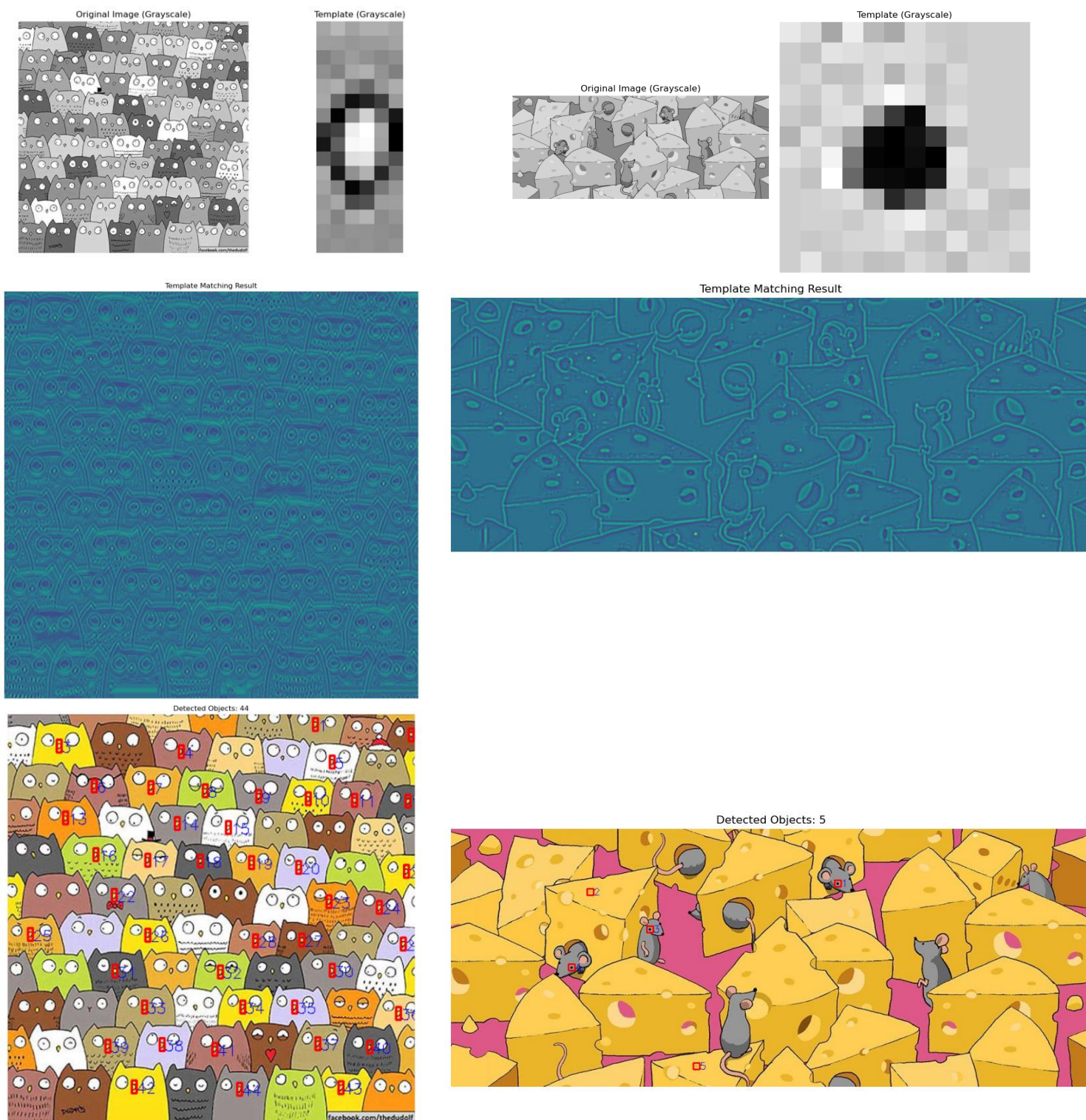
Trong đó:

- `scale_range`: khoảng resize của template
- `scale_steps`: số bước nhảy trong `scale_range`

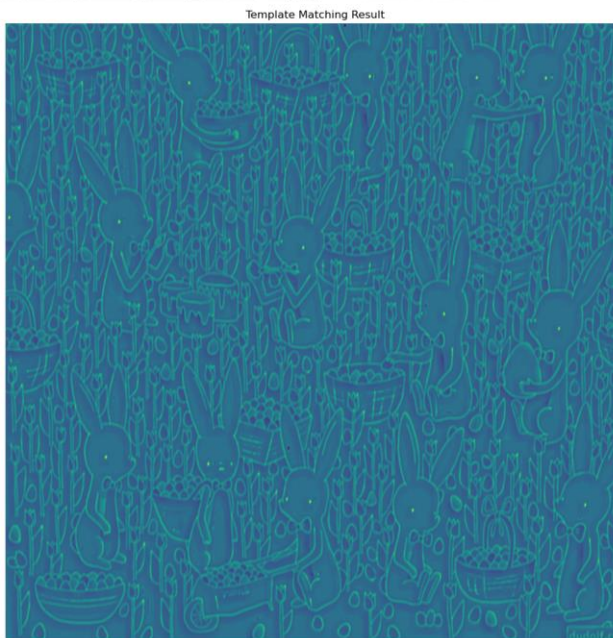
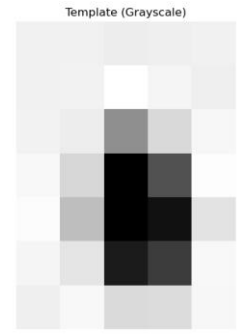
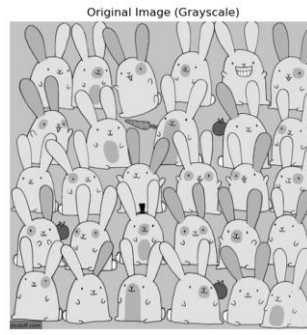
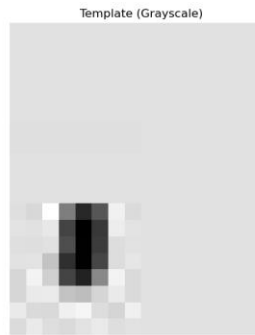
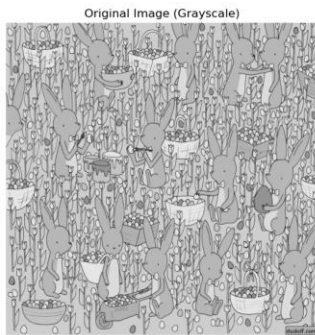
Do ma trận template có thể có kích thước khác so với kích thước của đối tượng trong `img` nên cần phải resize template với các giá trị khác nhau trước khi sử dụng template matching.

2. Kết quả:

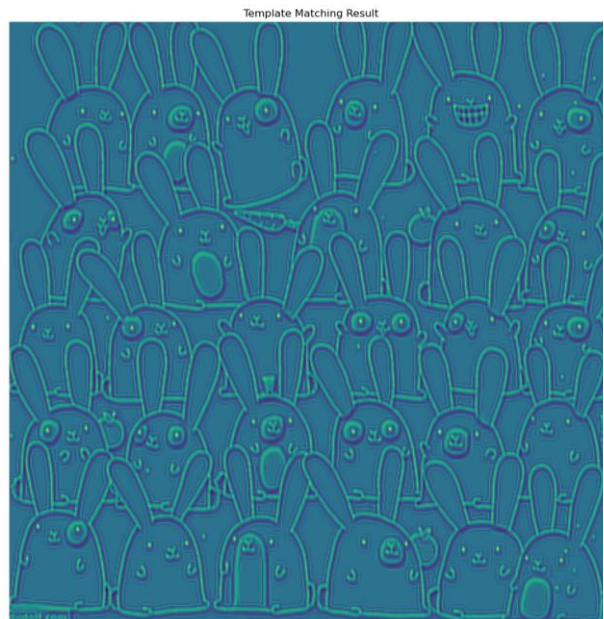
2.1. Đếm số lượng đối tượng



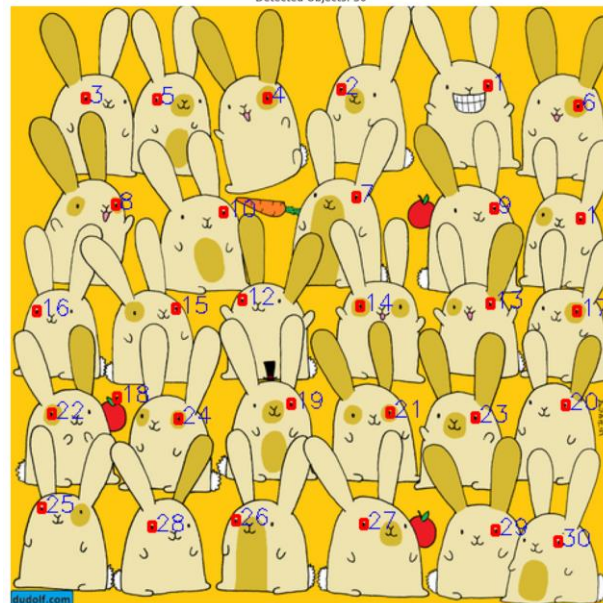
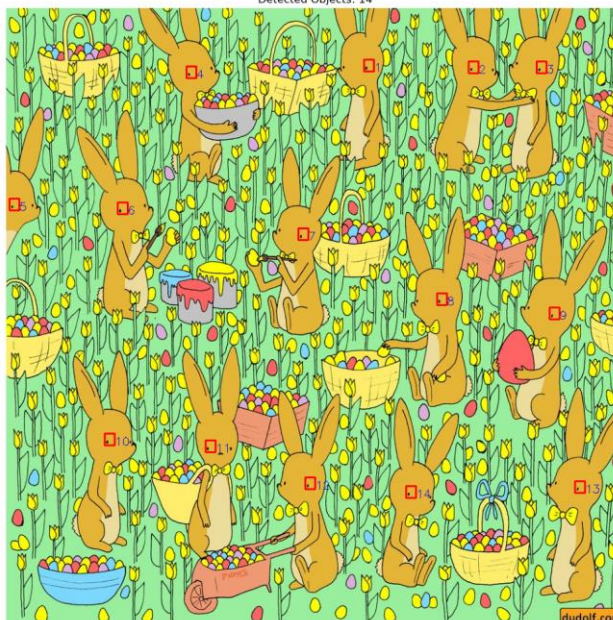
Hình 1: Đếm số chim và chuột



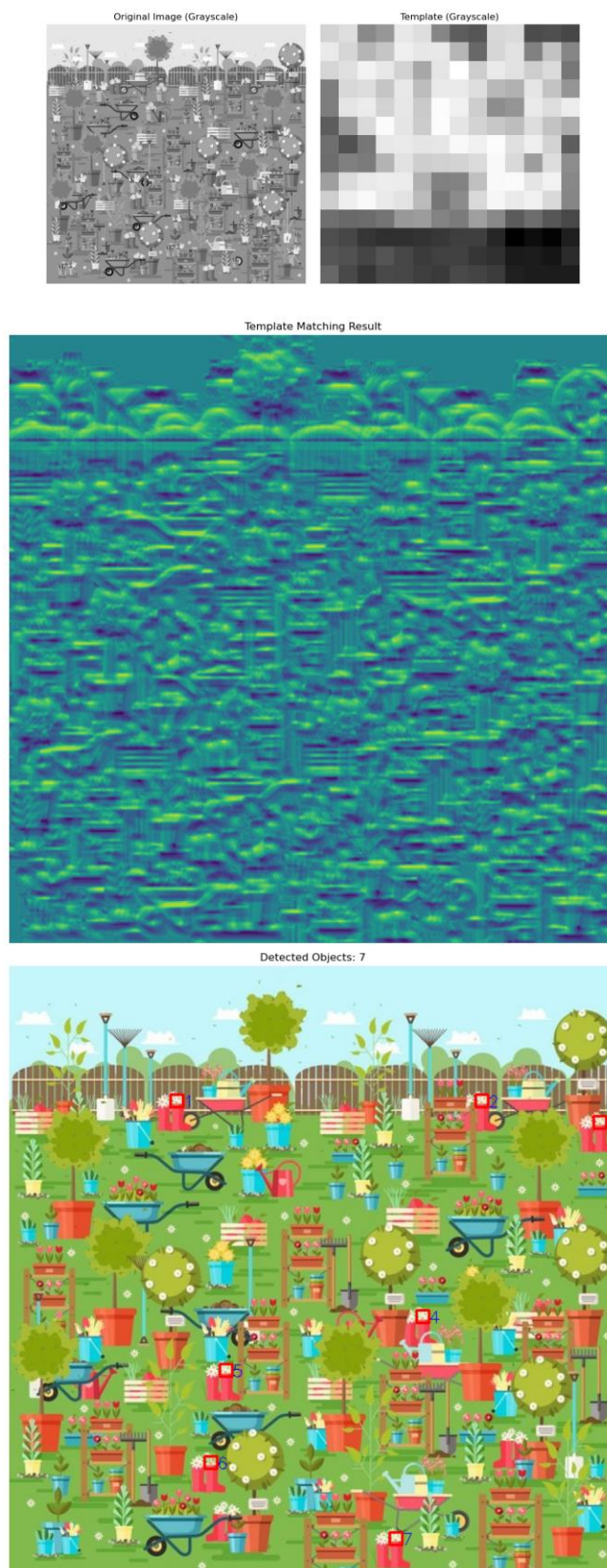
Detected Objects: 14



Detected Objects: 30



Hình 2: Đếm số thỏ

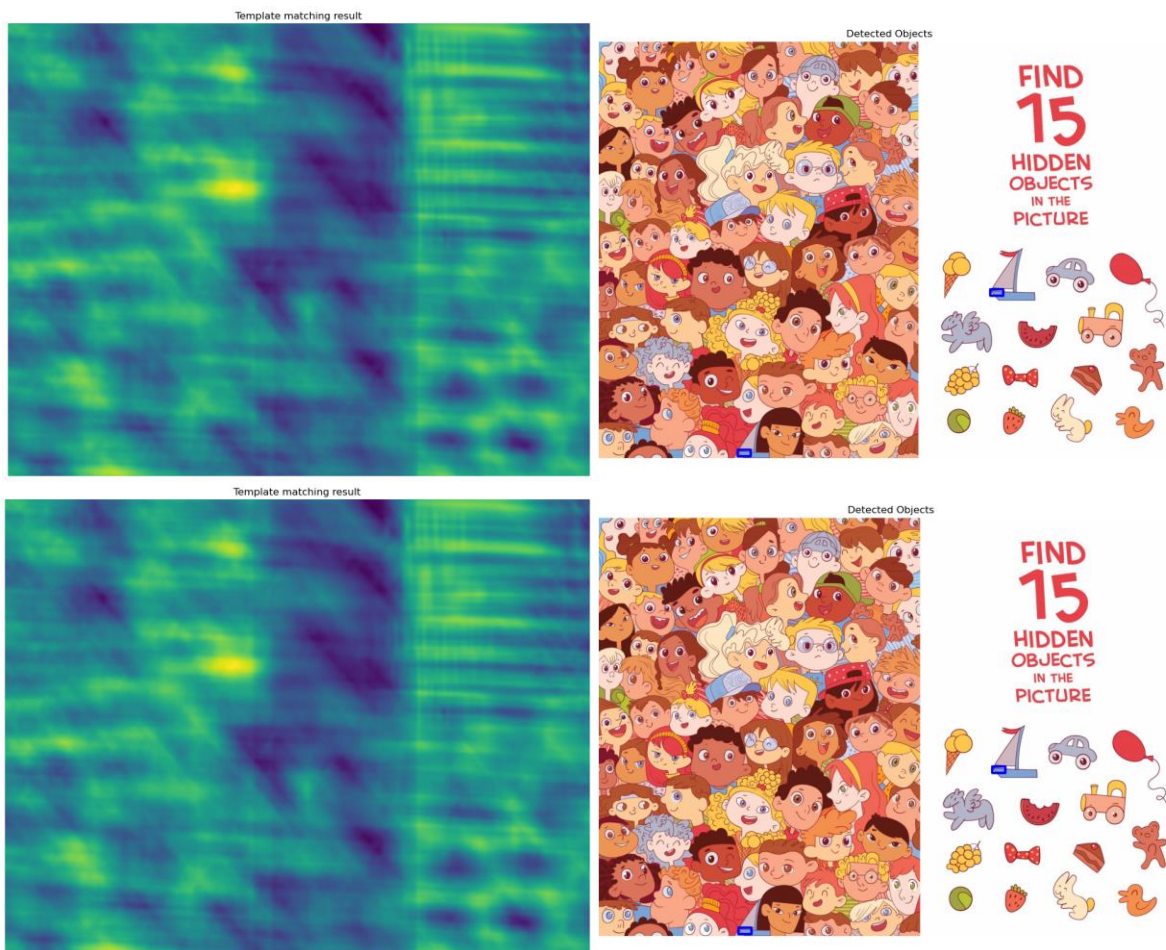


Hình 3: Đếm số đối ứng

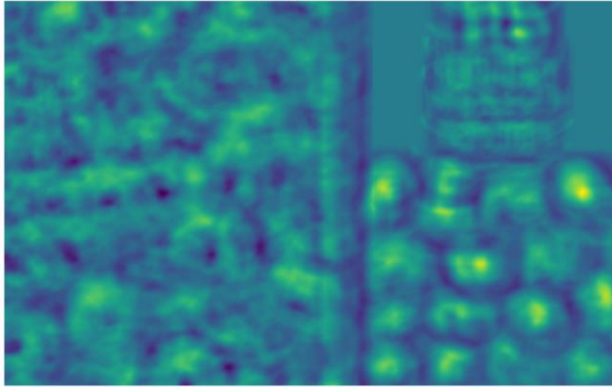
2.2. Tìm đối tượng



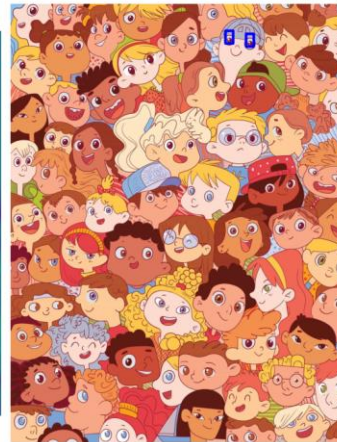
Hình 4: Tìm 15 vật thể



Template matching result



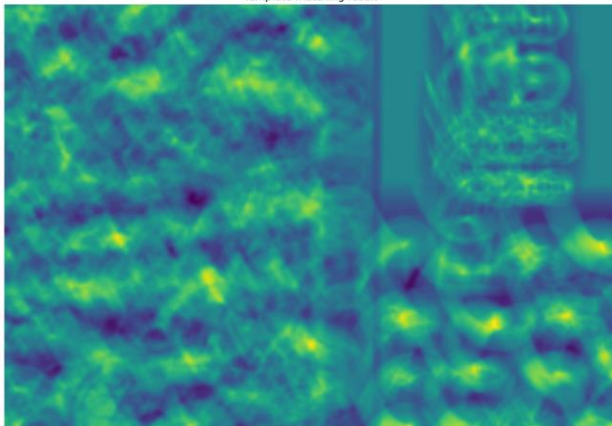
Detected Objects



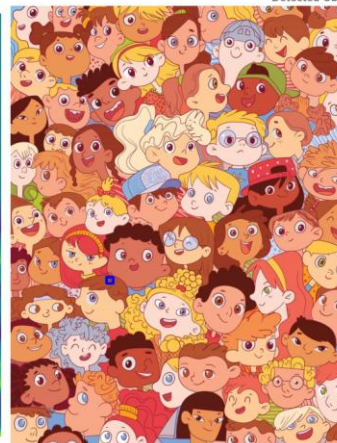
FIND
15
HIDDEN
OBJECTS
IN THE
PICTURE



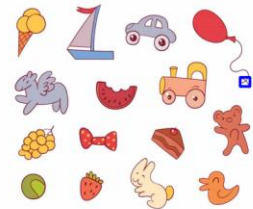
Template matching result



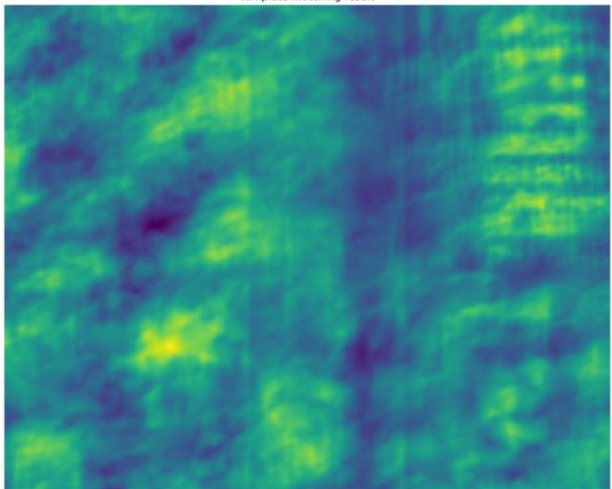
Detected Objects



FIND
15
HIDDEN
OBJECTS
IN THE
PICTURE



Template matching result



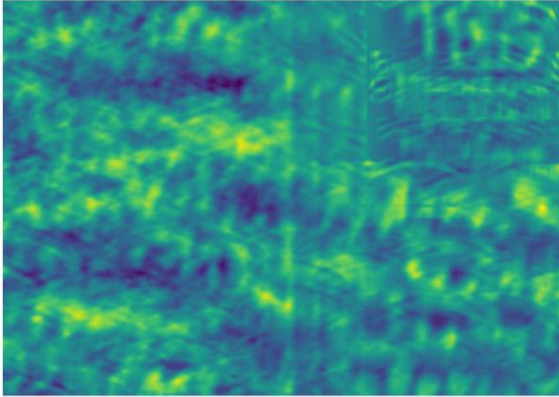
Detected Objects



FIND
15
HIDDEN
OBJECTS
IN THE
PICTURE



Template matching result



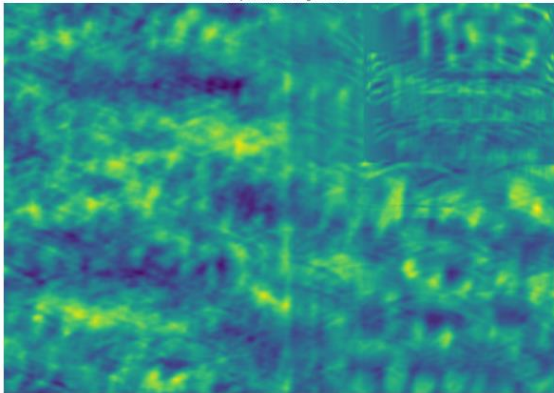
Detected Objects



FIND
15
HIDDEN
OBJECTS
IN THE
PICTURE



Template matching result



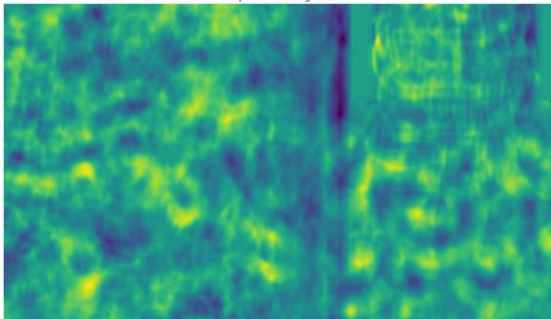
Detected Objects



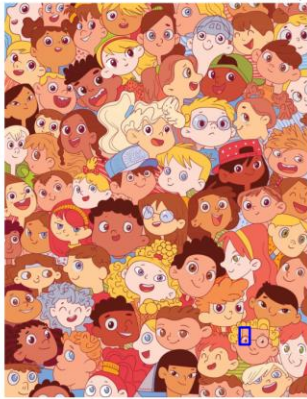
FIND
15
HIDDEN
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PICTURE



Template matching result



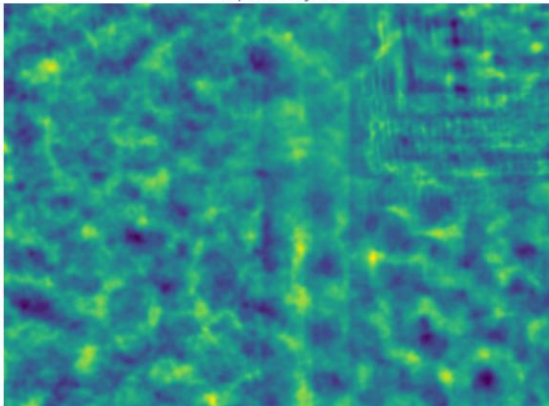
Detected Objects



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PICTURE



Template matching result



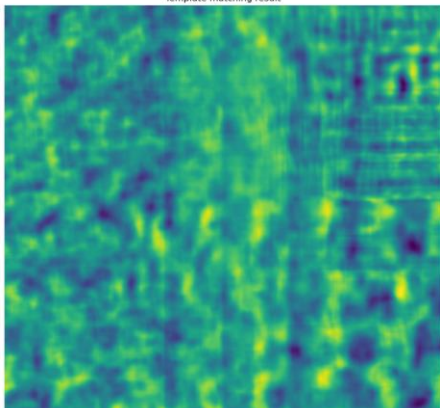
Detected Objects



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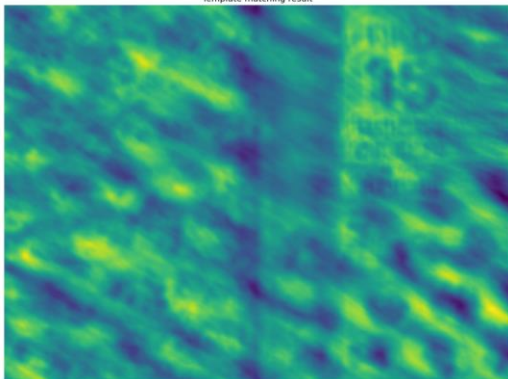
Template matching result



Detected Objects



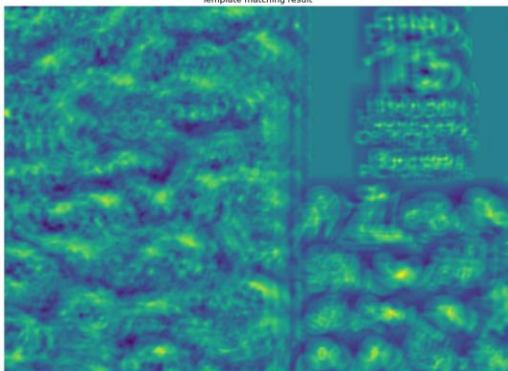
Template matching result



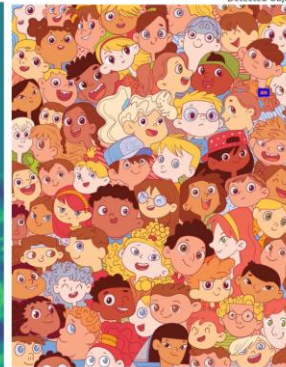
Detected Objects



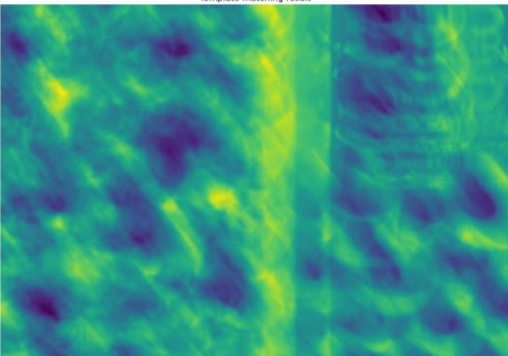
Template matching result



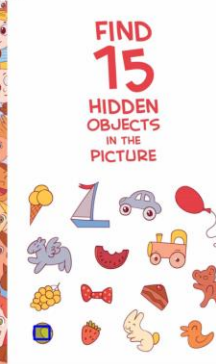
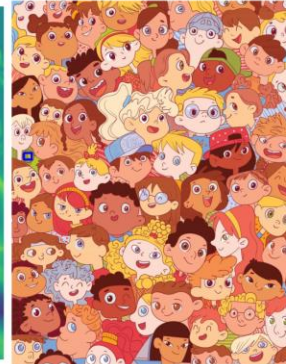
Detected Objects



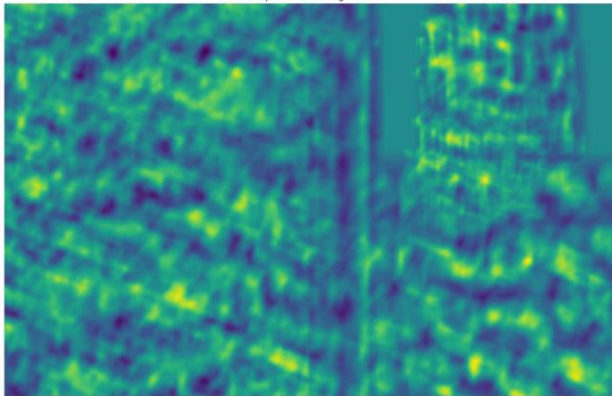
Template matching result



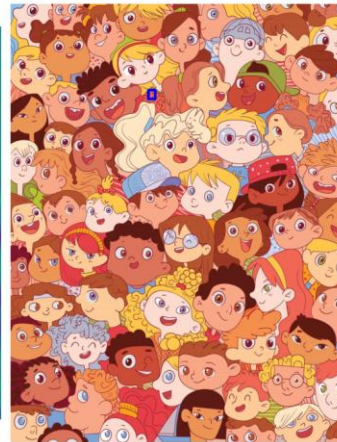
Detected Objects



Template matching result



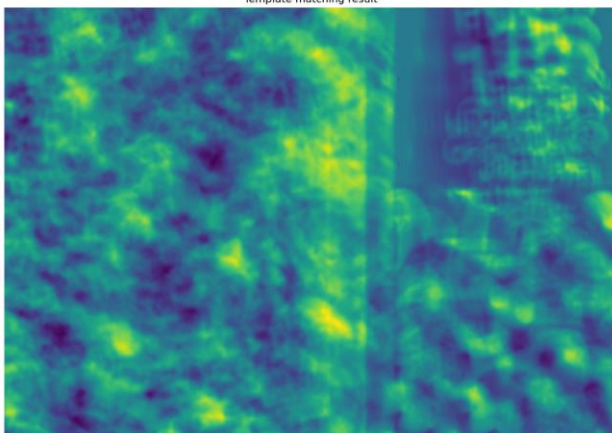
Detected Objects



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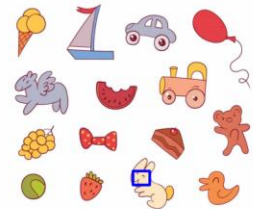
Template matching result



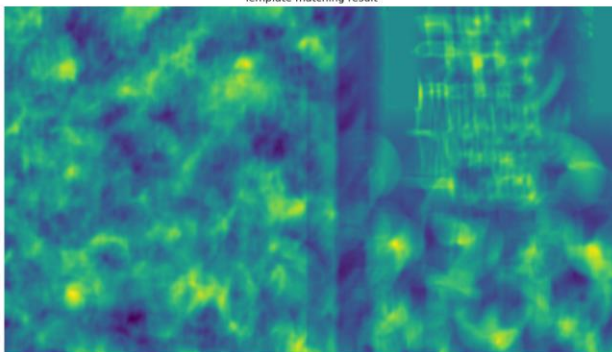
Detected Objects



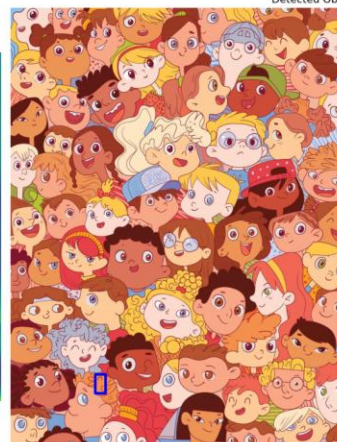
FIND
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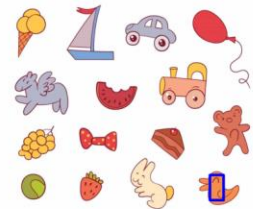
Template matching result



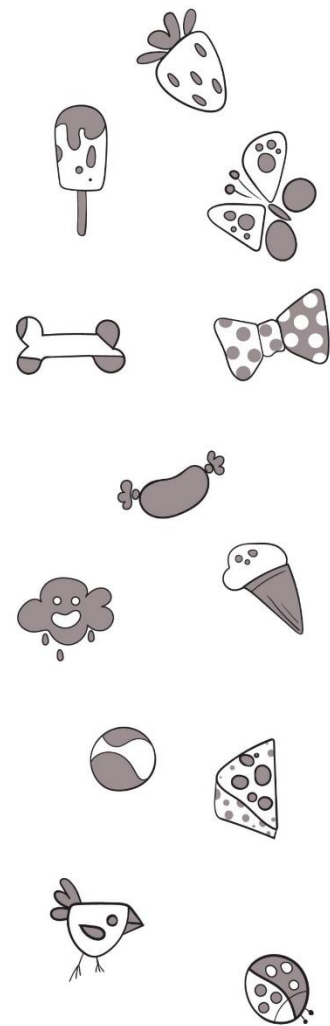
Detected Objects



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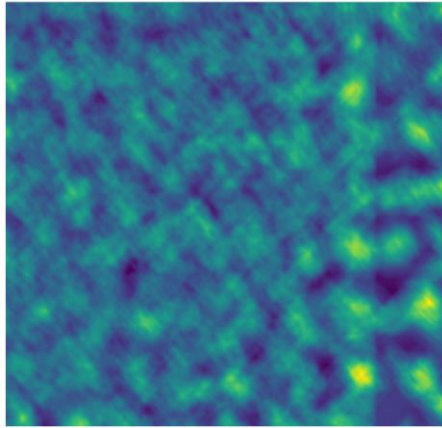


FIND 12 HIDDEN OBJECTS IN THE PICTURE



Hình 5: Tìm 12 vật thể

Template matching result

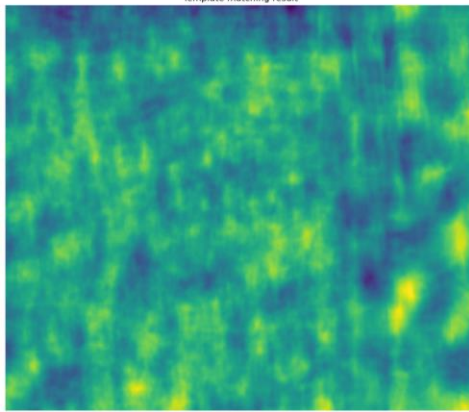


Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE

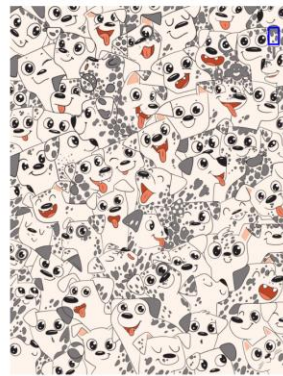


Template matching result

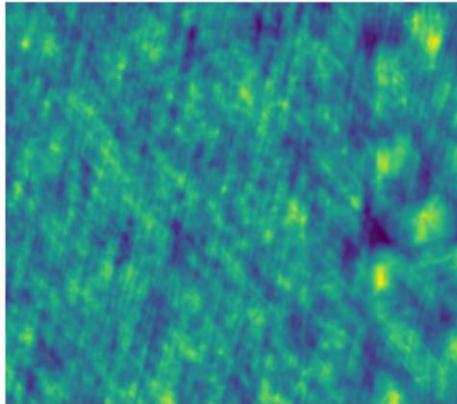


Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE



Template matching result

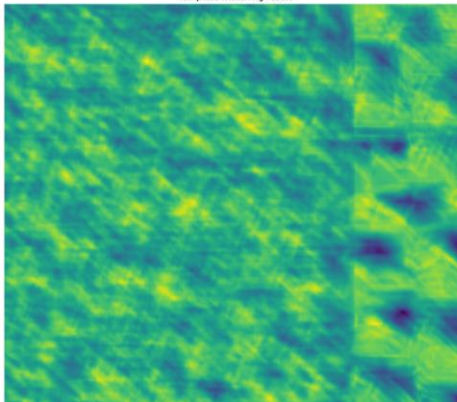


Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE

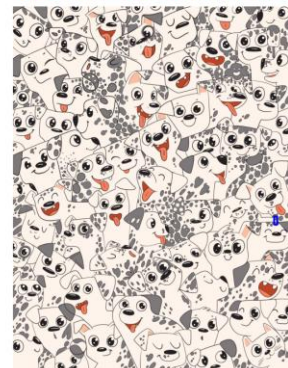


Template matching result

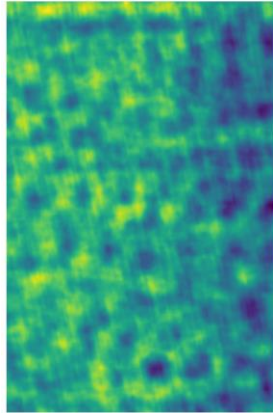


Detected Objects

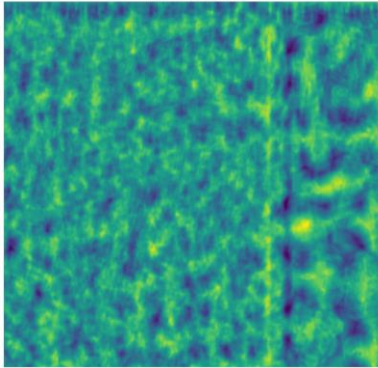
FIND 12 HIDDEN OBJECTS IN THE PICTURE



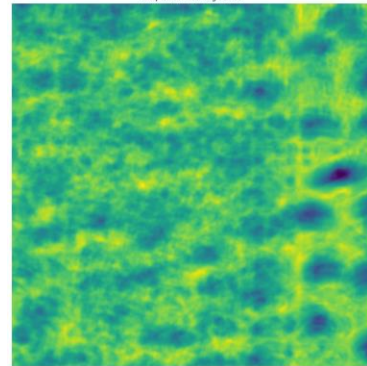
Template matching result



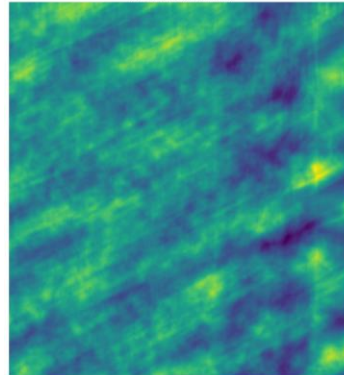
Template matching result



Template matching result

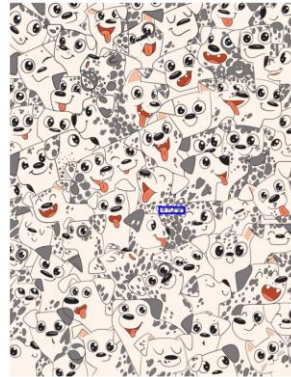


Template matching result



Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE



Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE



Detected Objects

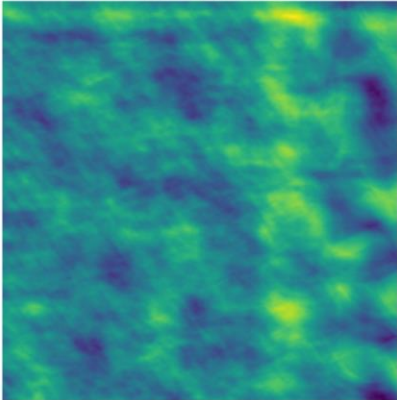


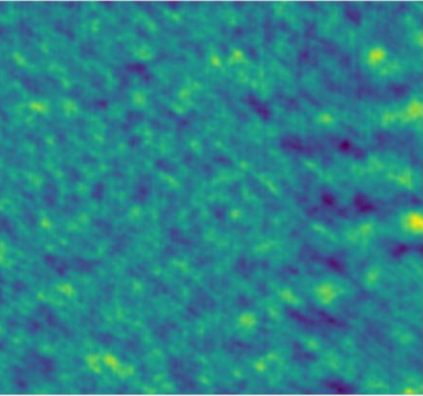


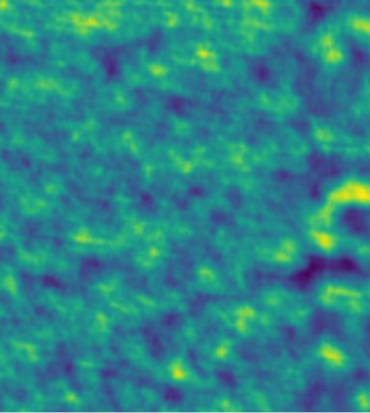


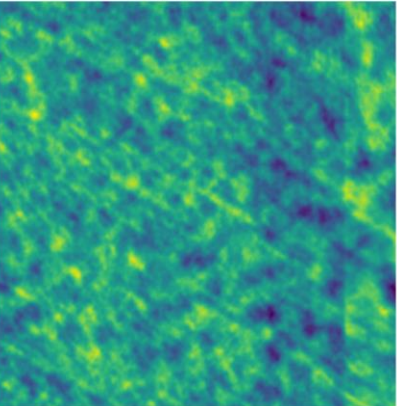
FIND 12 HIDDEN OBJECTS IN THE PICTURE



Detected Objects

FIND 12 HIDDEN OBJECTS IN THE PICTURE



	<p>Template matching result</p> 	<p>Detected Objects</p> <p>FIND 12 HIDDEN OBJECTS IN THE PICTURE</p>  
	<p>Template matching result</p> 	<p>Detected Objects</p> <p>FIND 12 HIDDEN OBJECTS IN THE PICTURE</p>  
	<p>Template matching result</p> 	<p>Detected Objects</p> <p>FIND 12 HIDDEN OBJECTS IN THE PICTURE</p>  
	<p>Template matching result</p> 	<p>Detected Objects</p> <p>FIND 12 HIDDEN OBJECTS IN THE PICTURE</p> 