

# Saliency Detection

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# Saliency – definition

- Saliency is defined as the most prominent part of the picture.
  - Eye fixation
  - Salient object detection



Here we can see that although the grass has more variance in color and texture the horse is the salient part.

# Saliency – definition

What is salient region here?



# Saliency—salient object

Answer:



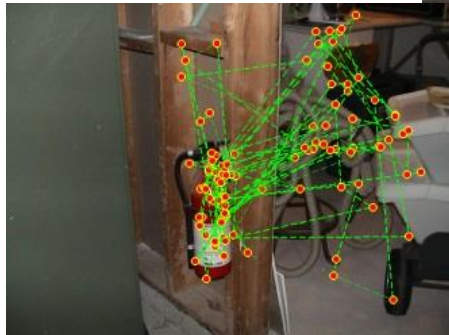
# Eye fixation

Image can have more than one salient area, and as a result some areas that are more salient than others:

Salient areas:

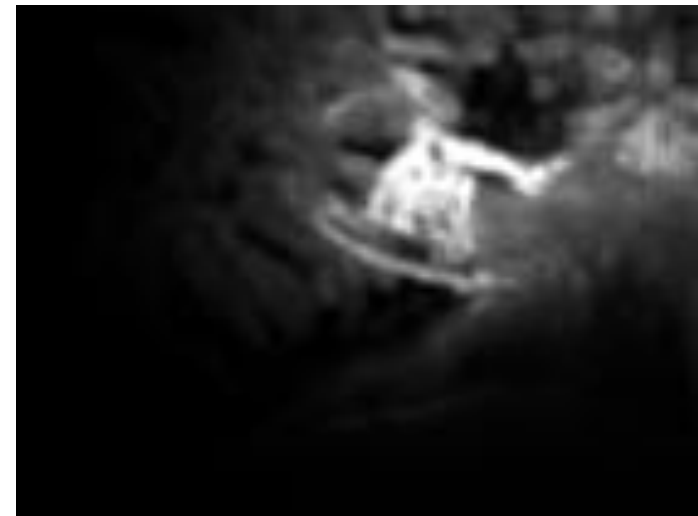
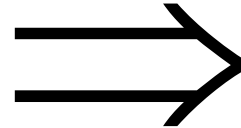


Also salient,  
but less.



# Saliency – definition

Our objective – saliency map:



# Visual Saliency Definition

Eye fixation prediction and salient object detection

# Human Eye Fixation Prediction

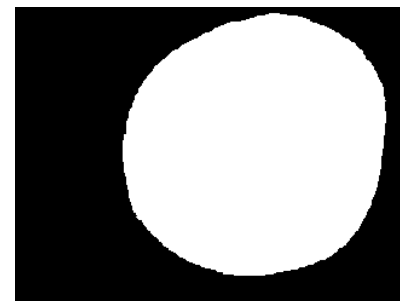
- Eye-tracker based ground truth
  - Sparse
  - center-bias Effect





# Salient Object Detection

- Manually labelled Ground-truth
  - Object can occupy most part of the image



# Two types of Saliency

- **Human eye fixation**

- **Methods**

- ITTI [Itti et al. PAMI 98]
    - AIM [Bruce et al. NIPS 06]
    - GBVS [Harel et al. NIPS 07]
    - DVA [Hou et al. NIPS 08]
    - SUN [Zhang et al. NIPS 08]
    - SIG [Hou et al. PAMI 12]

- **datasets**

- Bruce, Judd

- **Salient Object Detection**

- **Methods**

- FT [Achanta et al. CVPR 09]
    - GC [Cheng et al. CVPR 11]
    - SF [Perazzi et al. CVPR 12]
    - PCA-S [Margolin et al. CVPR 13]

- **Datasets**

- FT



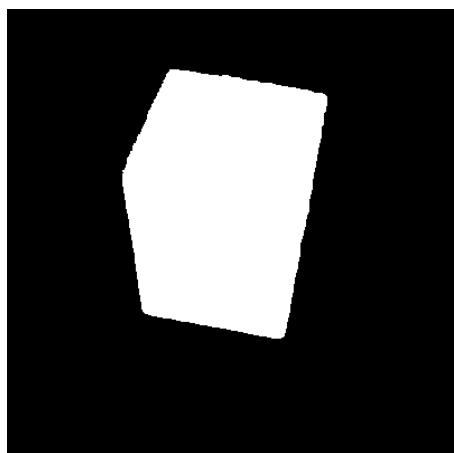
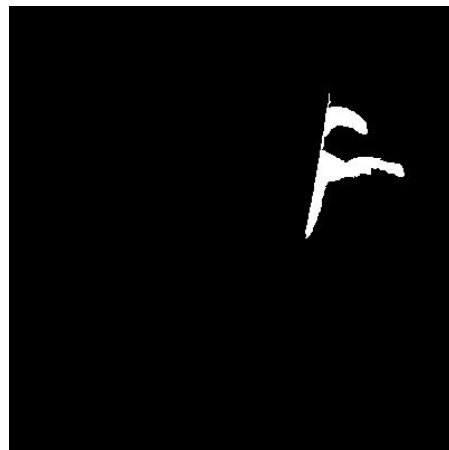
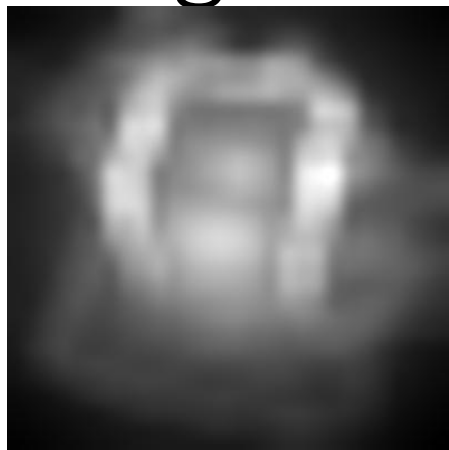
# MOTIVATION

Sometimes all you need are a few words of encouragement.

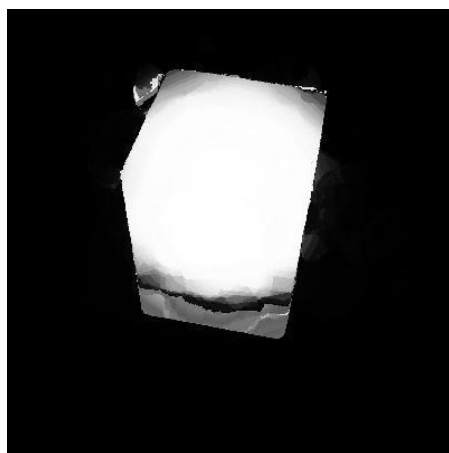
# Application: Image Segmentation



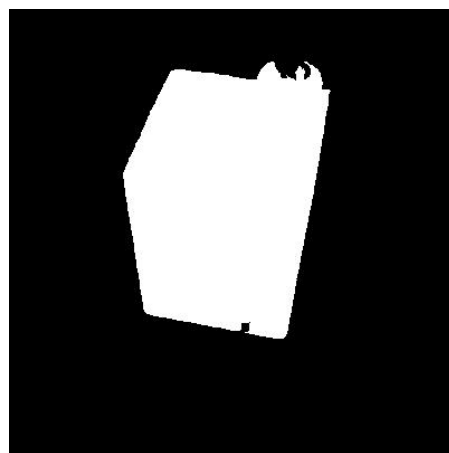
输入图像



真值图



显著图



分割结果

# Application: Image Retargeting





# Application: Image mosaic



Input



Mosaic



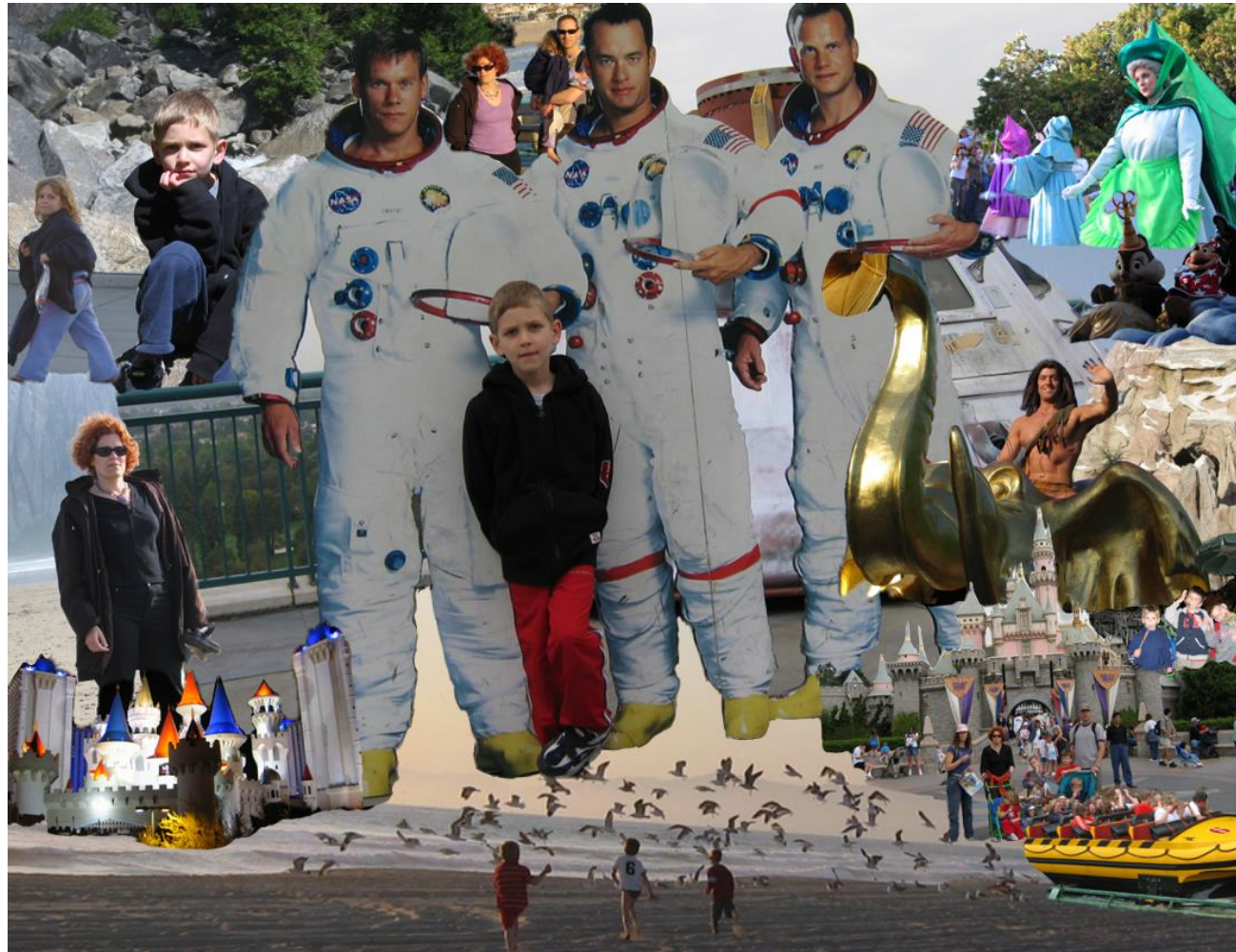
# Painterly Rendering

Painterly rendering – the fine details of the dominant objects are maintained, abstracting the background





# Summarization

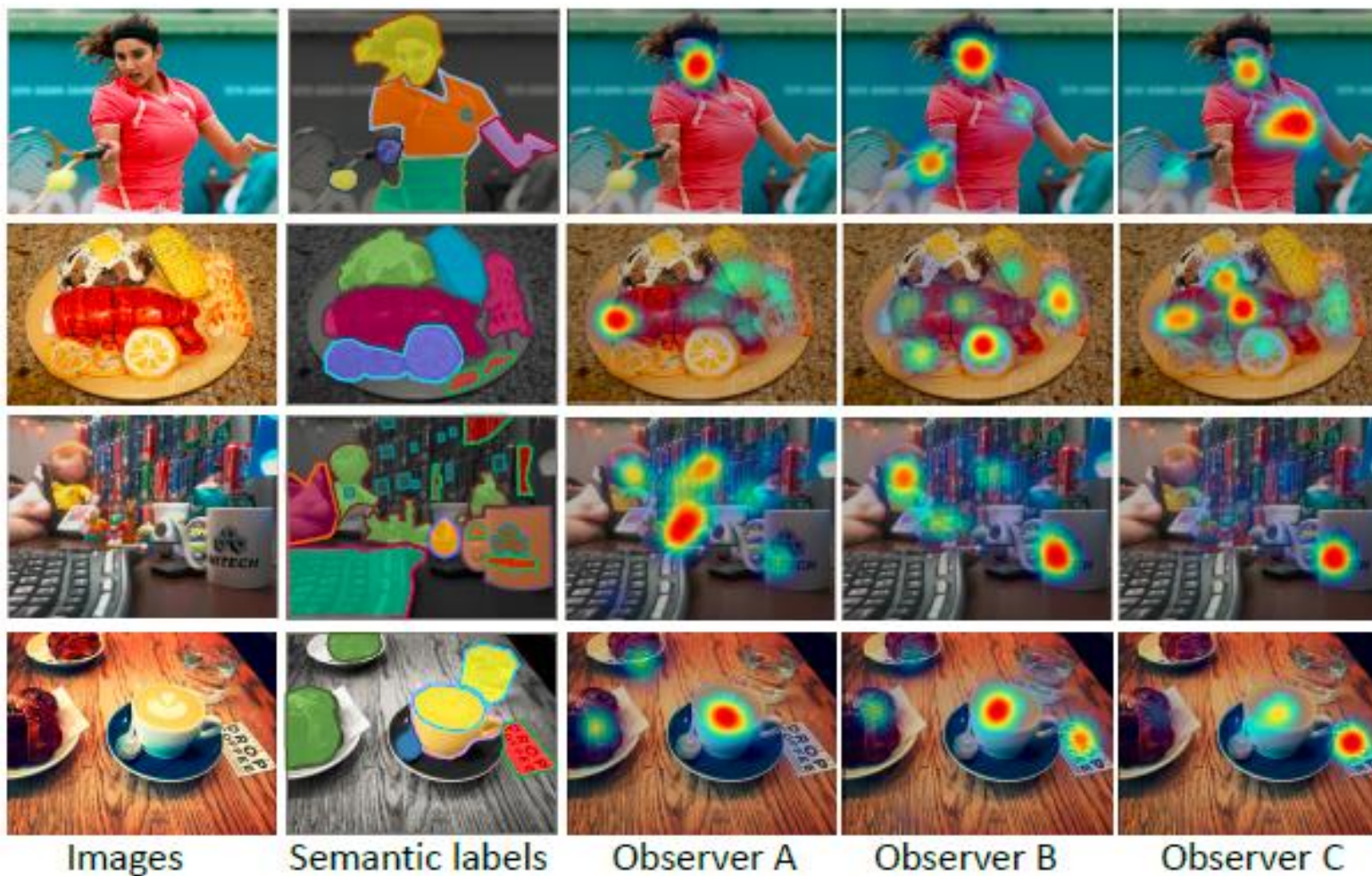




# Saliency detection datasets

- Two widely-used image datasets are the MIT dataset that contains 1,003 images viewed by 15 subjects and the NUSEF dataset that contains 758 (emotion evoking) images viewed by 25 subjects.
- The PASCAL-S datasets provide the ground truth for both eye fixation and object detection and consist of 850 images selected from PASCAL VOC dataset viewed by 8 subjects.
- The iSUN datasets a large scale dataset used for eye fixation prediction, contains 20,608 images from the SUN database. The images are completely annotated and are viewed by users.
- The SALICON dataset consists of 10,000 images from the popular MS COCO image datasets with rich contextual information.

# Personalized Saliency Detection



# PASCAL-S Datasets

**From Human Eye Fixation to Salient Object Detection**

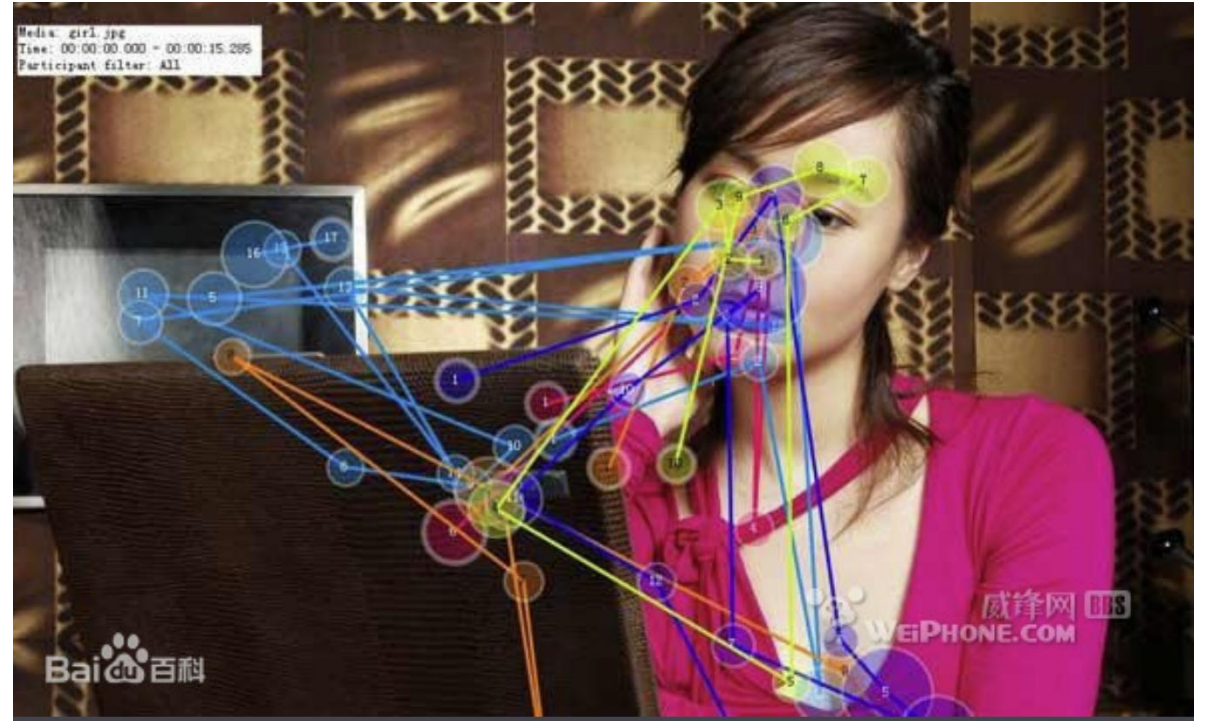
眼动有三种基本方式:

注视 (fixation)

眼跳 (saccades)

追随运动 (pursuit movement)

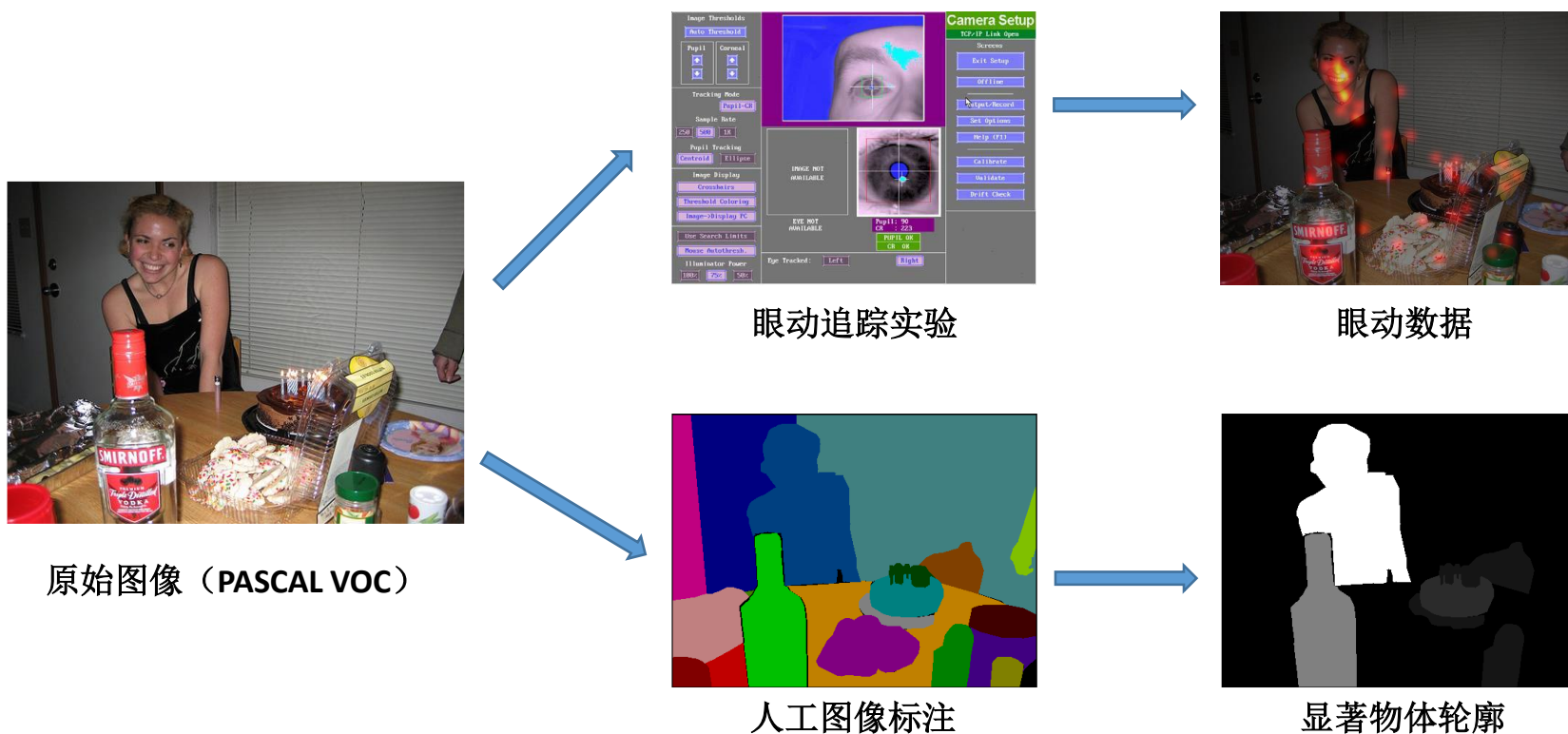
眼动仪: Eye Tracker





# Human Eye Fixation and Salient Object Detection

- Source: PASCAL VOC dataset



# Human Eye Fixation and Salient Object Detection

- **Human Eye Fixation**

- 8 persons
- Each person looks at the given image for 2 seconds
- Record the movement of eyes

**PASCAL-VOC is the most fair dataset in object detection**

*[Unbiased look at dataset bias] CVPR 10*

- **Salient Object Detection**

- 12 persons
- Manually labeled the ground truth



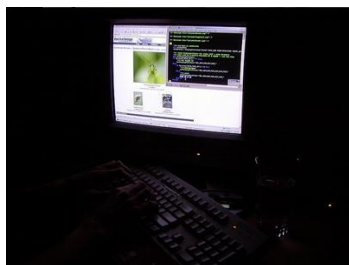
Antonio Torralba/MIT Efron (Alexi) Alyosha/UCB

# 数据集的偏差

PASCAL-S



FT



**FT** 数据集过度强调了视觉显著性的概念

- 显著物体位于图像中心附近
- 显著物体具有清晰的边缘
- 单个显著物体，背景单一

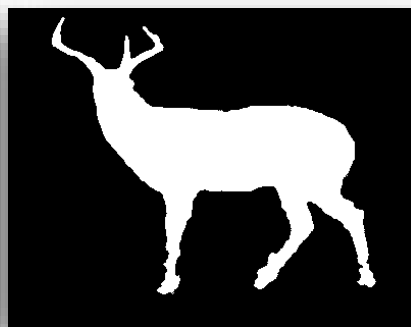
# From eye fixation to salient object Segmentation

**Salient Object Segmentation= Eye fixation prediction + image  
segmentation**



- “显著性物体检测”

- 一个从图像中检测出最能引起人的视觉注意的物体区域的计算机视觉处理过程

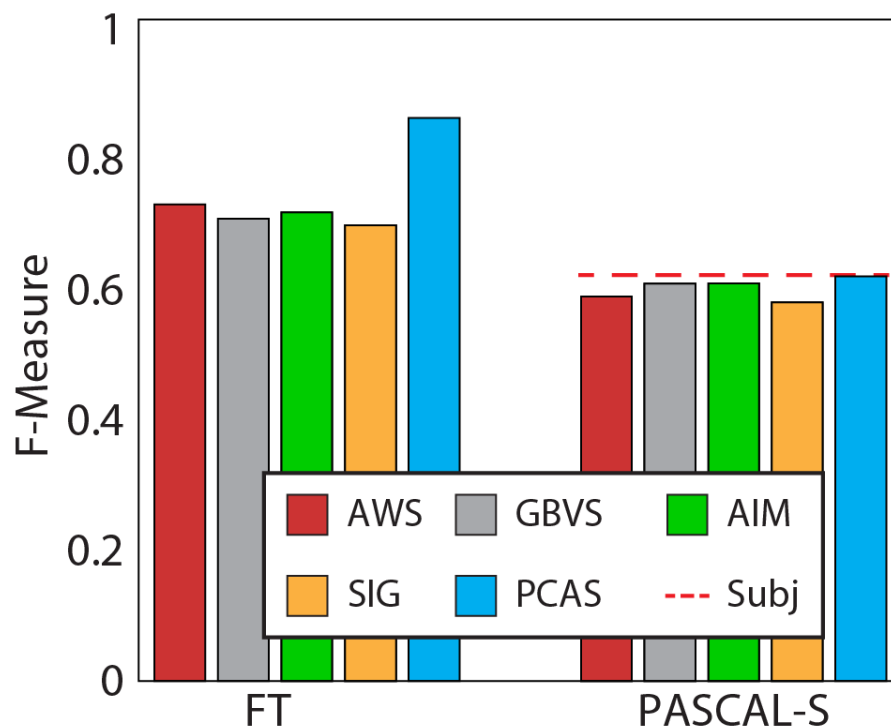


- 理想的显著性物体检测算法

- 高准确率
  - 高分辨率
  - 可以快速的计算

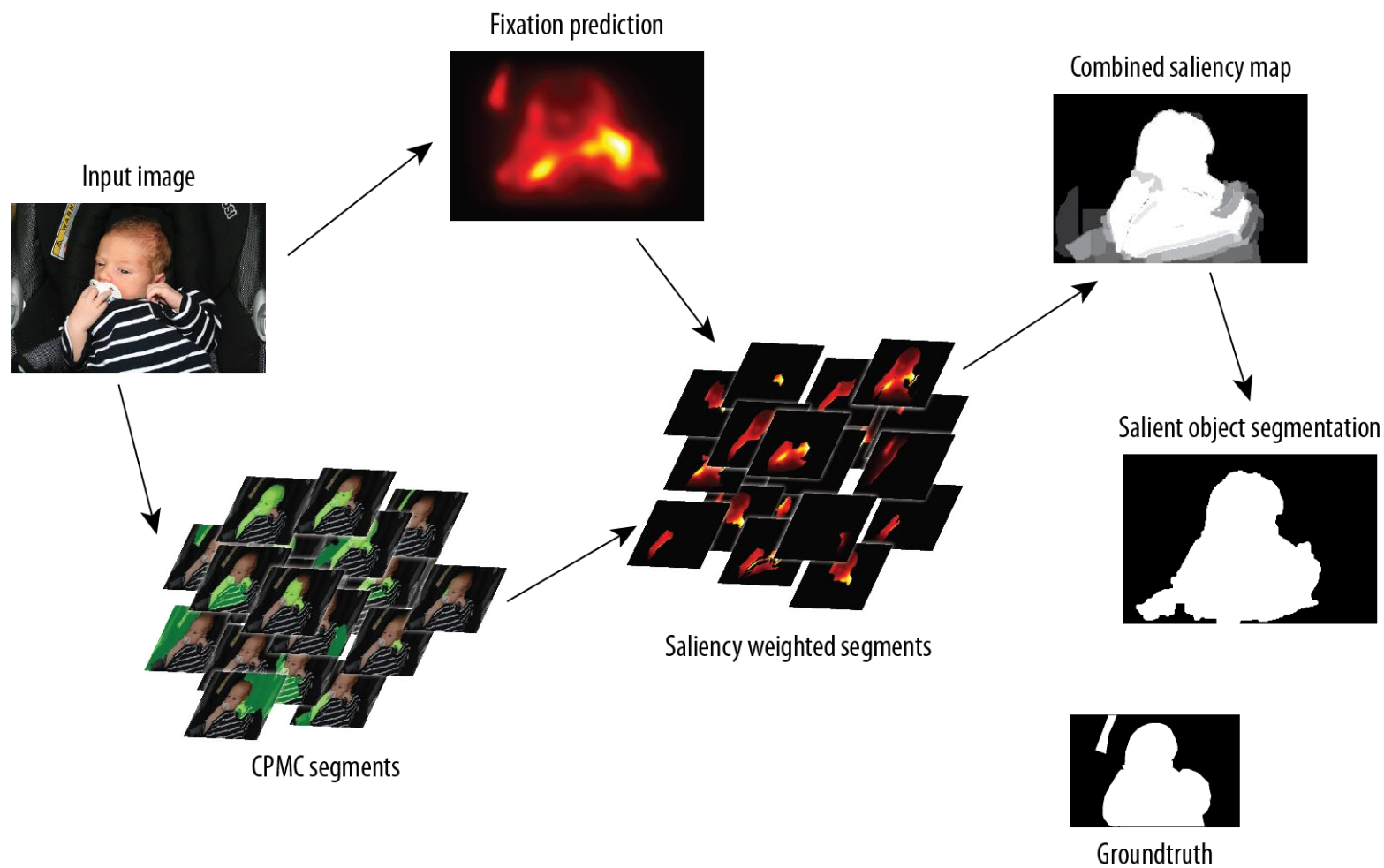
# 眼动预测直接用于显著物体分割？

- FT数据集：结果明显差于显著物体分割算法
- PASCAL-S数据集：结果与显著物体分割算法持平
- 眼动预测无法给出物体的准确边界 ☹️



- **PCAS** 显著物体分割算法
- **AWS, GBVS, AIM, SIG** 4中主流的眼动预测算法

# 眼动预测 → 显著物体



# Homework 1

- How to evaluate the performance of different methods for eye fixation?
  - How to evaluate the performance of different methods for salient object detection?
  - Survey all existing saliency detection datasets and how the ground truth annotated in these datasets.
- 
- Due date: March 6, 2020
  - Email: cv2\_hw@sina.com