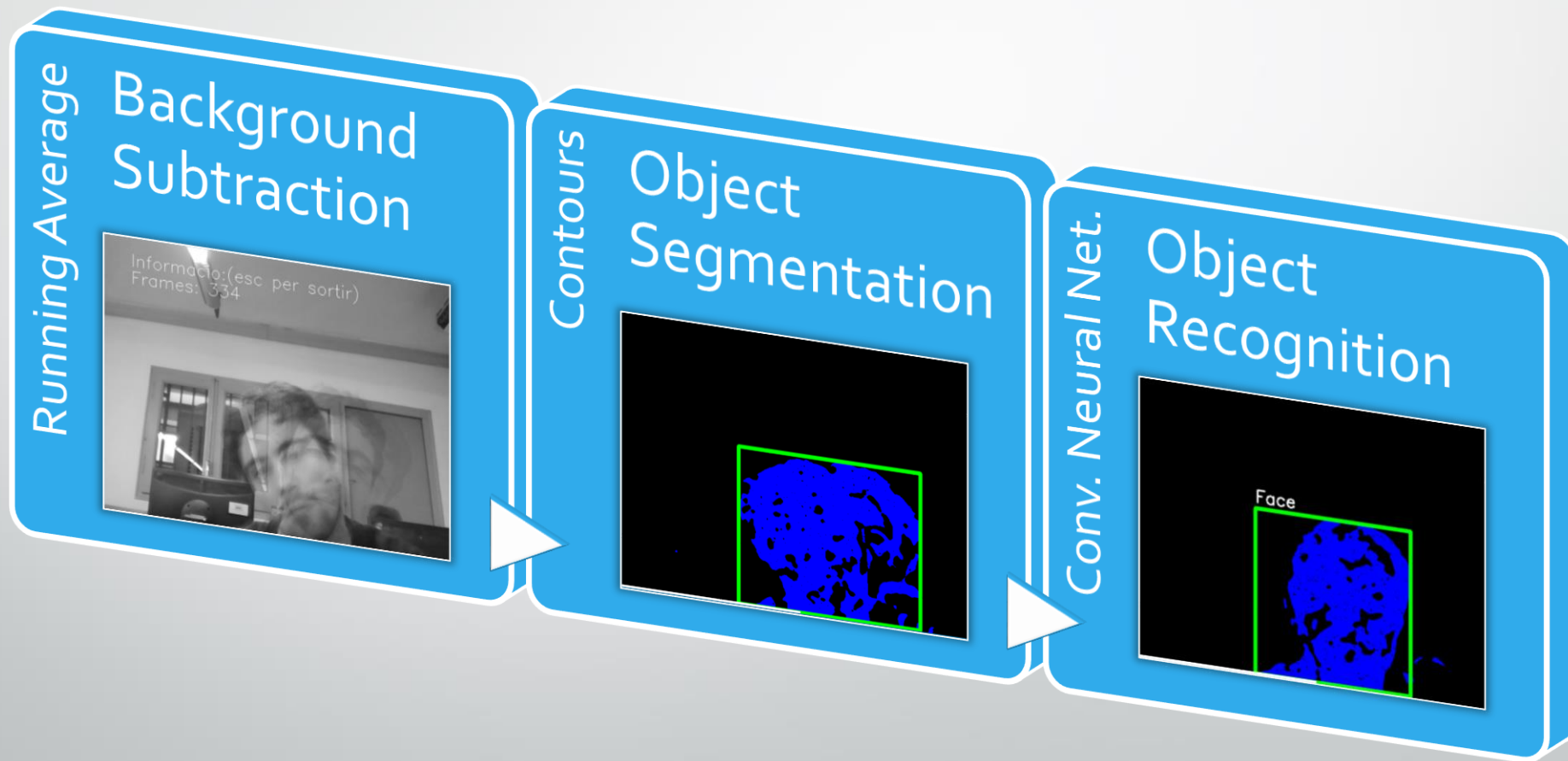


# Background Subtraction applied to Object Recognition

By using Convolutional Neural Networks

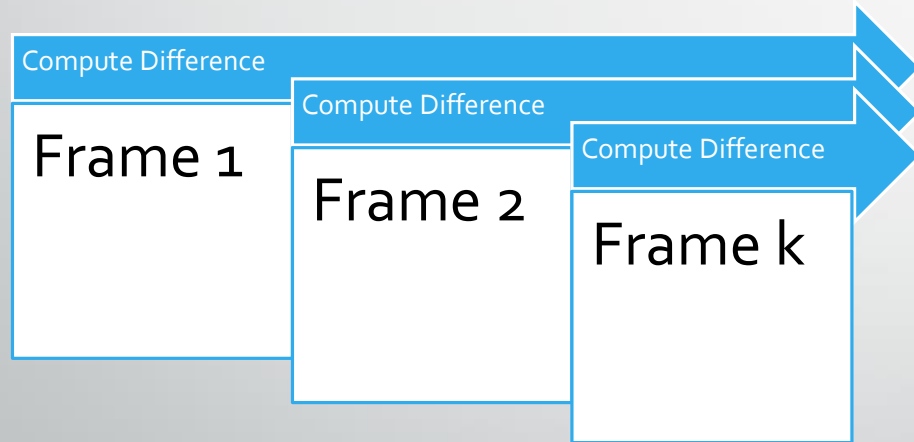
Cristian Muriel  
Guillem Pascual

# Goals



# Running Average

Variable background



$\alpha$  = Learning Rate

$$BG' = BG * (1 - \alpha) + \text{minFrame} * \alpha$$

# Object Segmentation

1. Subtract background to current frame
2. Threshold and noise reduction
3. Apply distance function to avoid mixing/merging two close objects
4. Threshold image by a small amount (avoid close objects again)
5. Find external contours by using Canny

# Convolutional Neural Network

- CNN:
  - Jia, Yangqing
  - Caffe: Convolutional Architecture for Fast Feature Embedding
- C++/CUDA Library with wrappers for Python and Matlab
- Deep Learning
- Training time of 2 hours, with:
  - GPU: NVIDIA GTX 650 TI 2GB
  - CPU: Intel i7 3.60GHz
  - Images:

|                 |             |                    |
|-----------------|-------------|--------------------|
| • 13.233 Faces  | • 515 Blue  | • 154 Skin texture |
| • 870 Suitcases | • 432 Gray  | • 159 Purple       |
| • 381 Black     | • 44 Yellow |                    |

# Conclusions

- Background Subtraction is an efficient and fast method for mobile objects detection
- Segmentation through external contours works but might mix objects
- Convolutional neural networks are perfect solutions for multiple object classifying, although:
  - Small datasets might prove insufficient and cause the net to misclassify
  - High computational training cost
- Applicable to Video Surveillance and Lost/Forgot object detection