CS 510
Computational Photography-Spring 2018
Final Project Presentation

PhD Husnu Melih Erdogan – Electrical & Computer Engineering

herdogan@pdx.edu

Portland State
UNIVERSITY

Panoramic Images for Robot Vison

Portland State
UNIVERSITY

Outline

- Introduction
- Motivation
- Steps to Create Panorama
- Results
- Questions

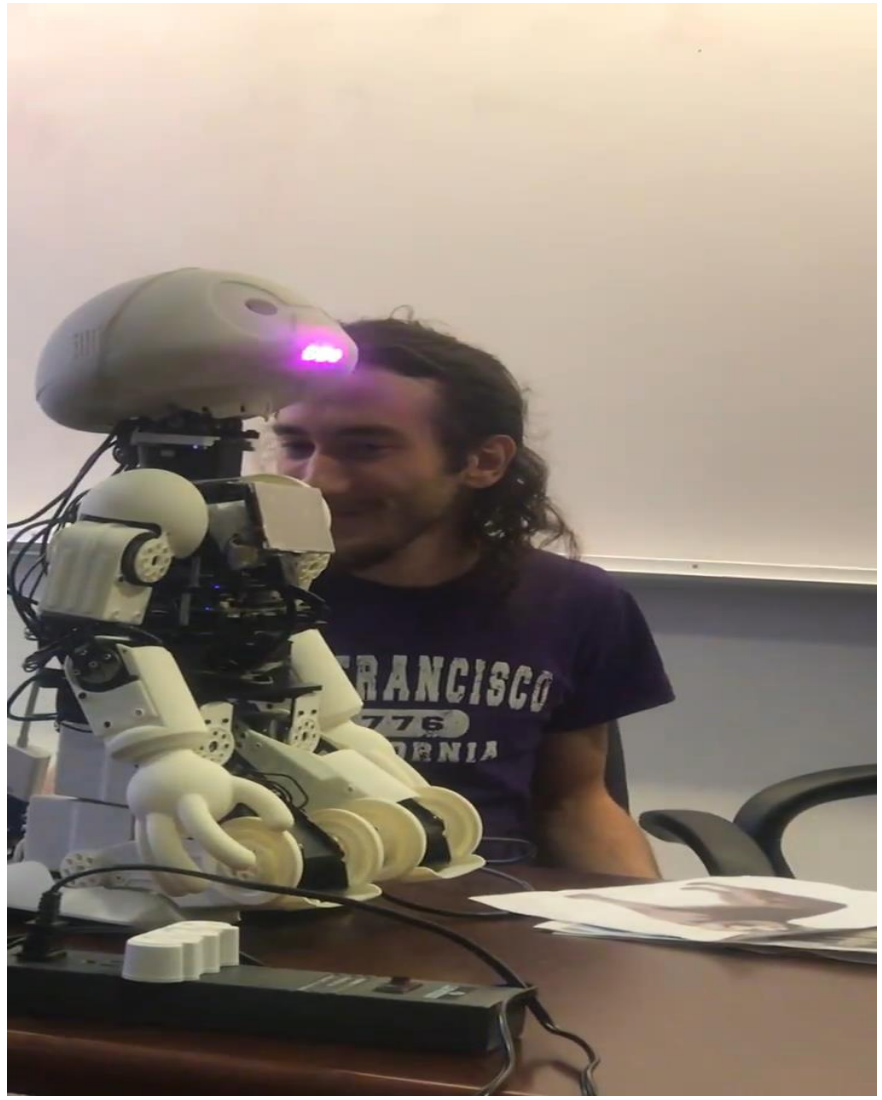
Portland State UNIVERSITY

Introduction

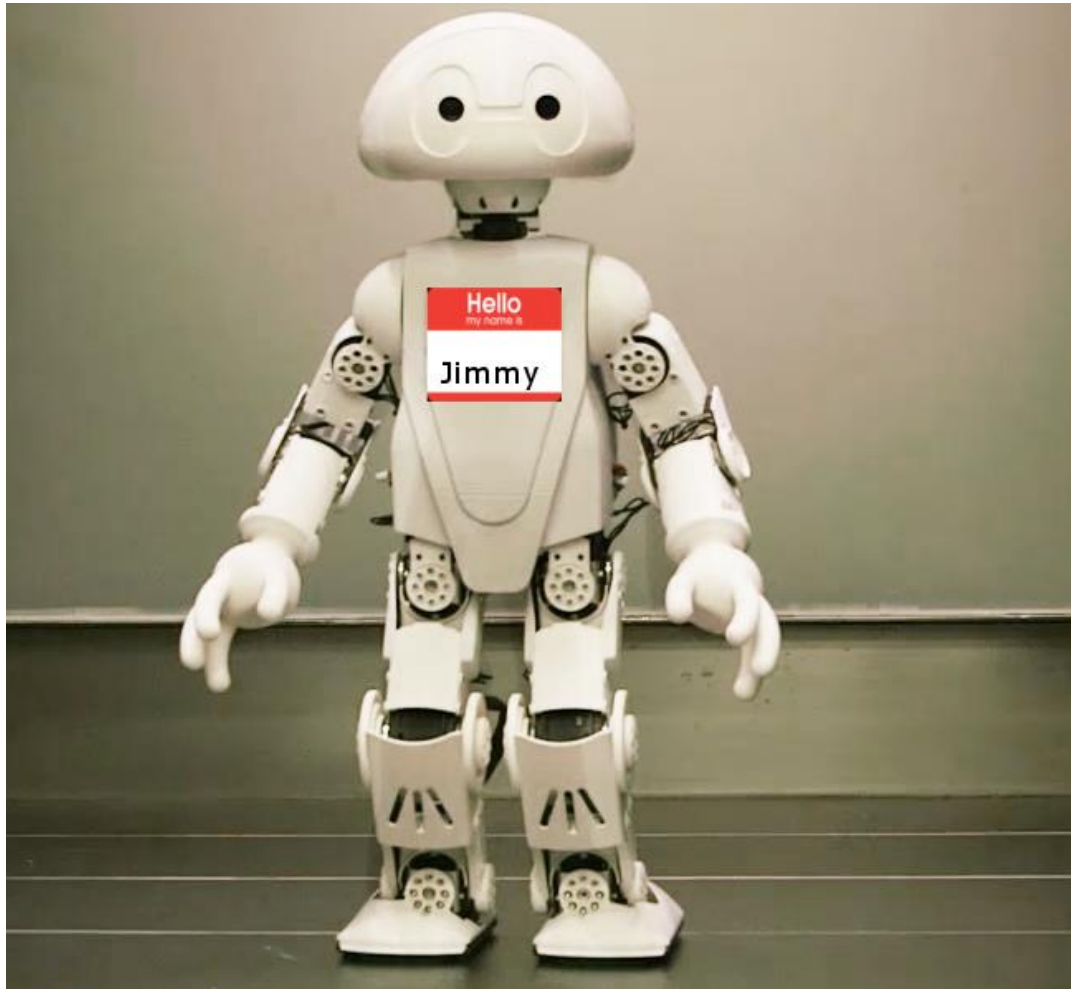
- Often one camera for object recognition is not enough
- Not all objects captured in an image
- Using two cameras to create a panorama and use that panoramic image for object detection

Motivation

- Our robot Jimmy needs a better vision system



Test Setup



- 21 DOF (Degrees of Freedom)
- 2 x 5MP RGB Cameras
- Microphone
- LCD Display
- NUC with Intel i5 processor
- Touch Sensors
- Ubuntu 14.04
- ROS (Robot Operating System)
- Python 3.4
- OpenCV

Portland State UNIVERSITY

5 Steps to Make Panorama

Step 1

Capture Images

Step 2

Feature Detection & Matching

Step 3

Align Images

Step 4

Blending

Step 5

Cropping

Step 1 – Capture Images

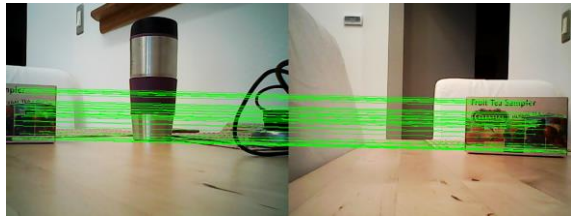
Capture Images

- Create a mask for the warped image

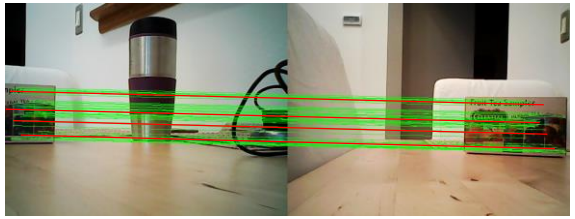
Create a mask size of 2 images

Step 2 - Feature Detection and Matching

Find Matches - SIFT

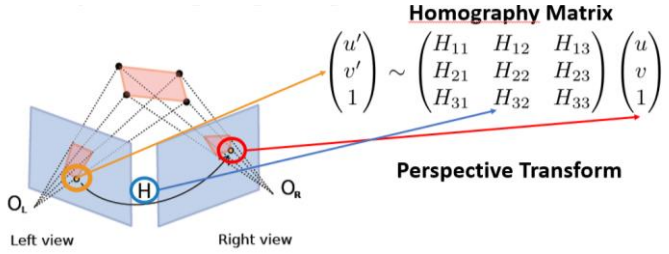


RANSAC



Step 3 – Aligning Images

Calculate Homography and warp the image

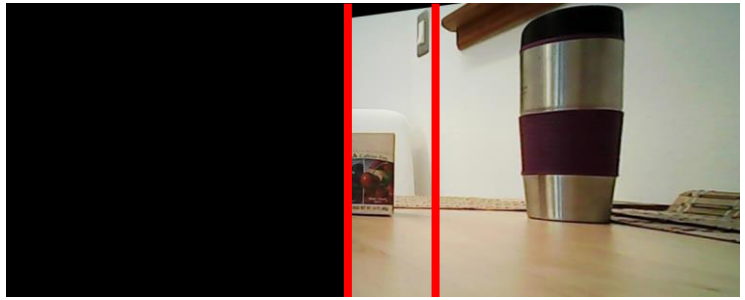


Portland State UNIVERSITY

Step 4 Blending

Overlap 20%

Overlap 20%



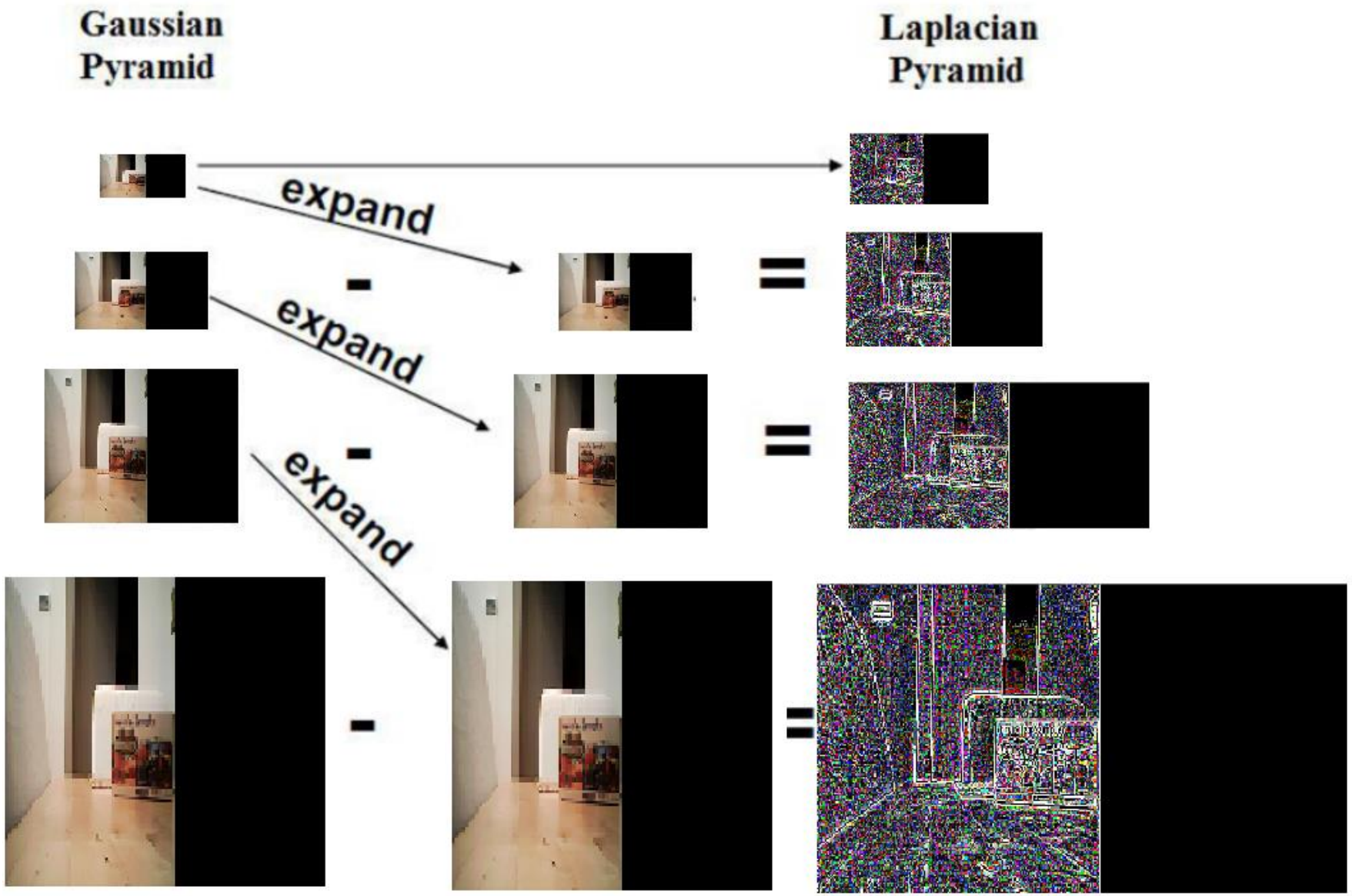
Preprocessing images

- **Create a mask for input images**

- **Create a mask for the final image**

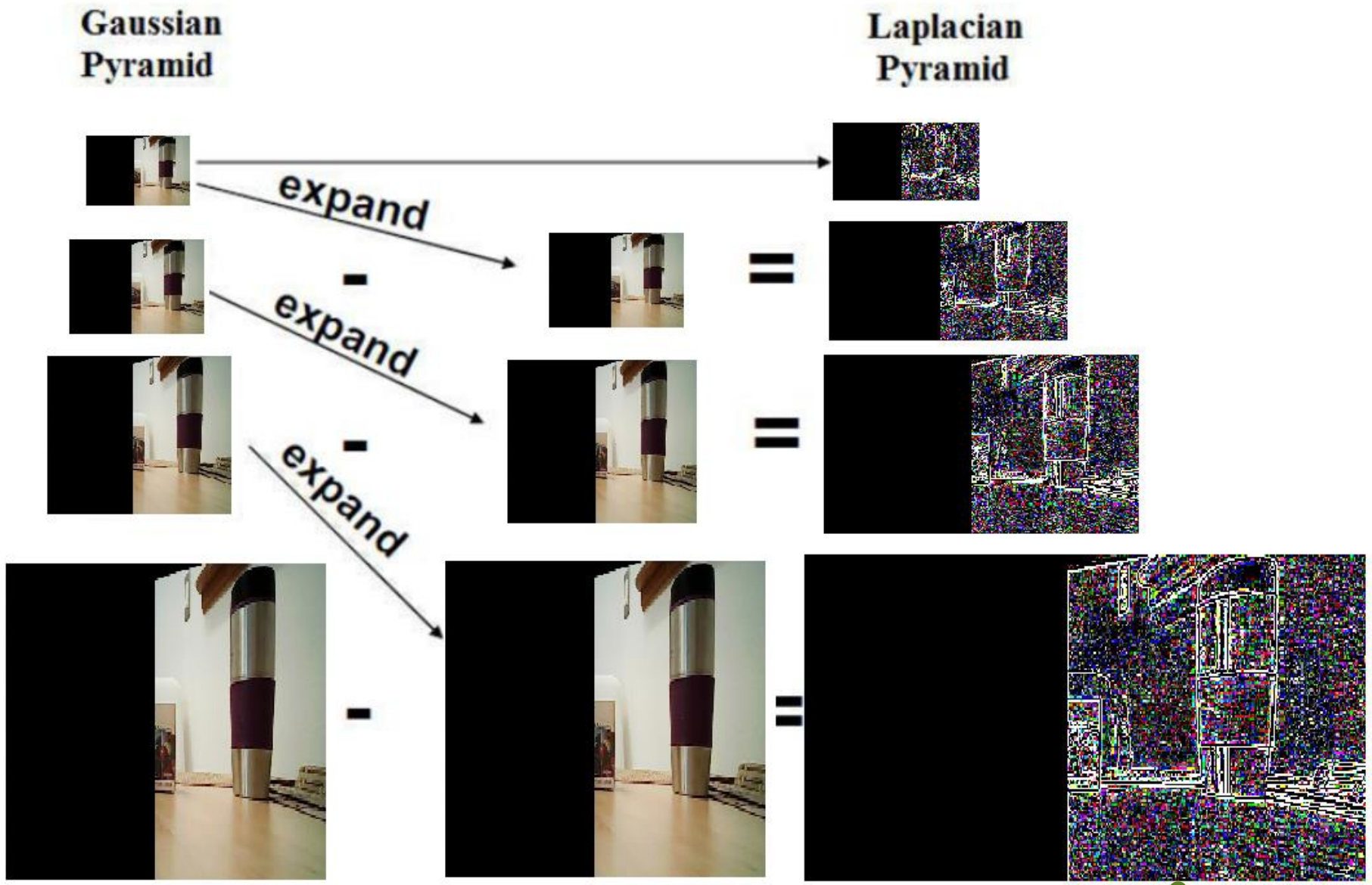
Step 4 Blending

- Build Laplacian pyramids LA

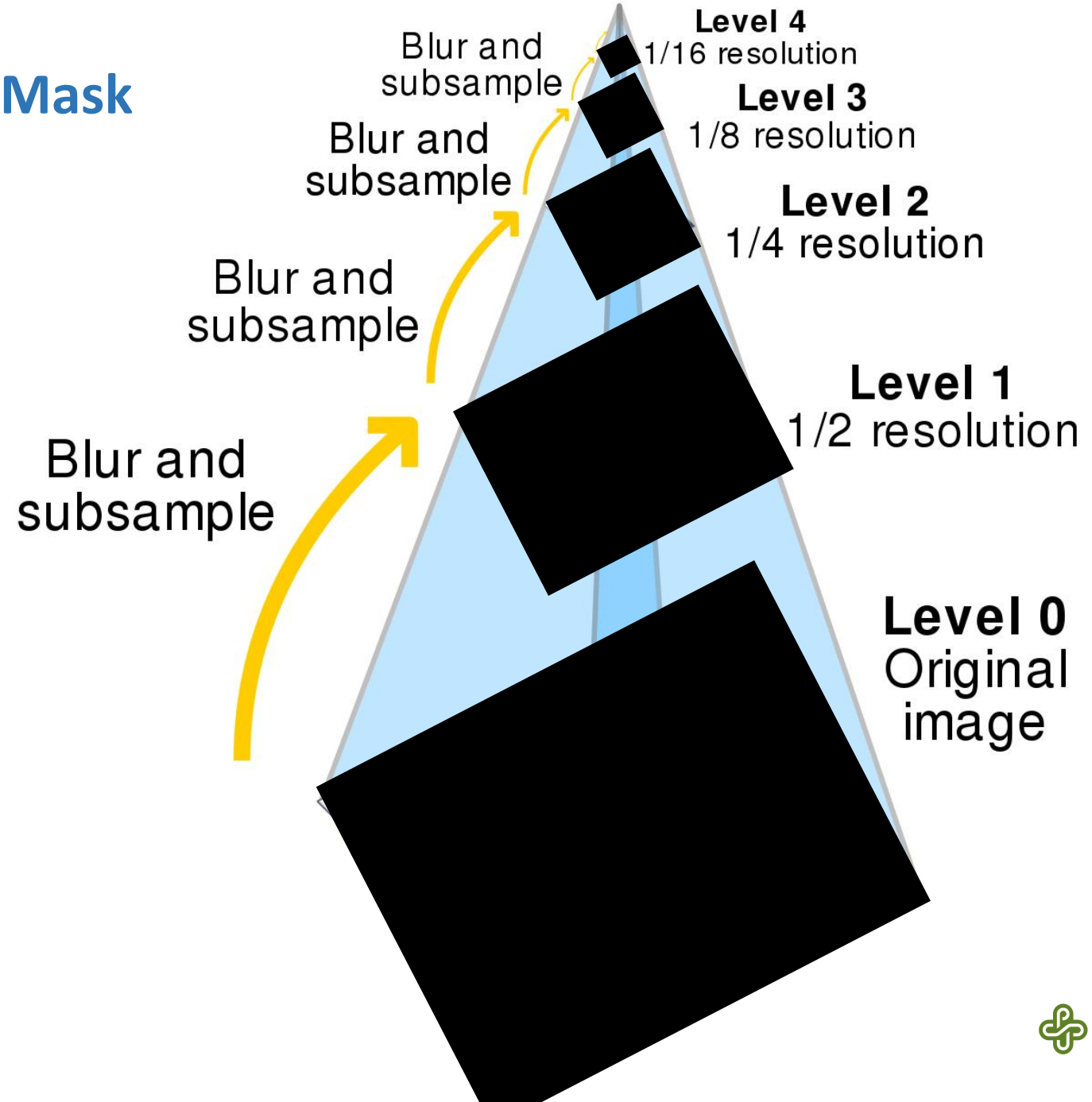


Step 4 Blending

- Build Laplacian pyramids LB



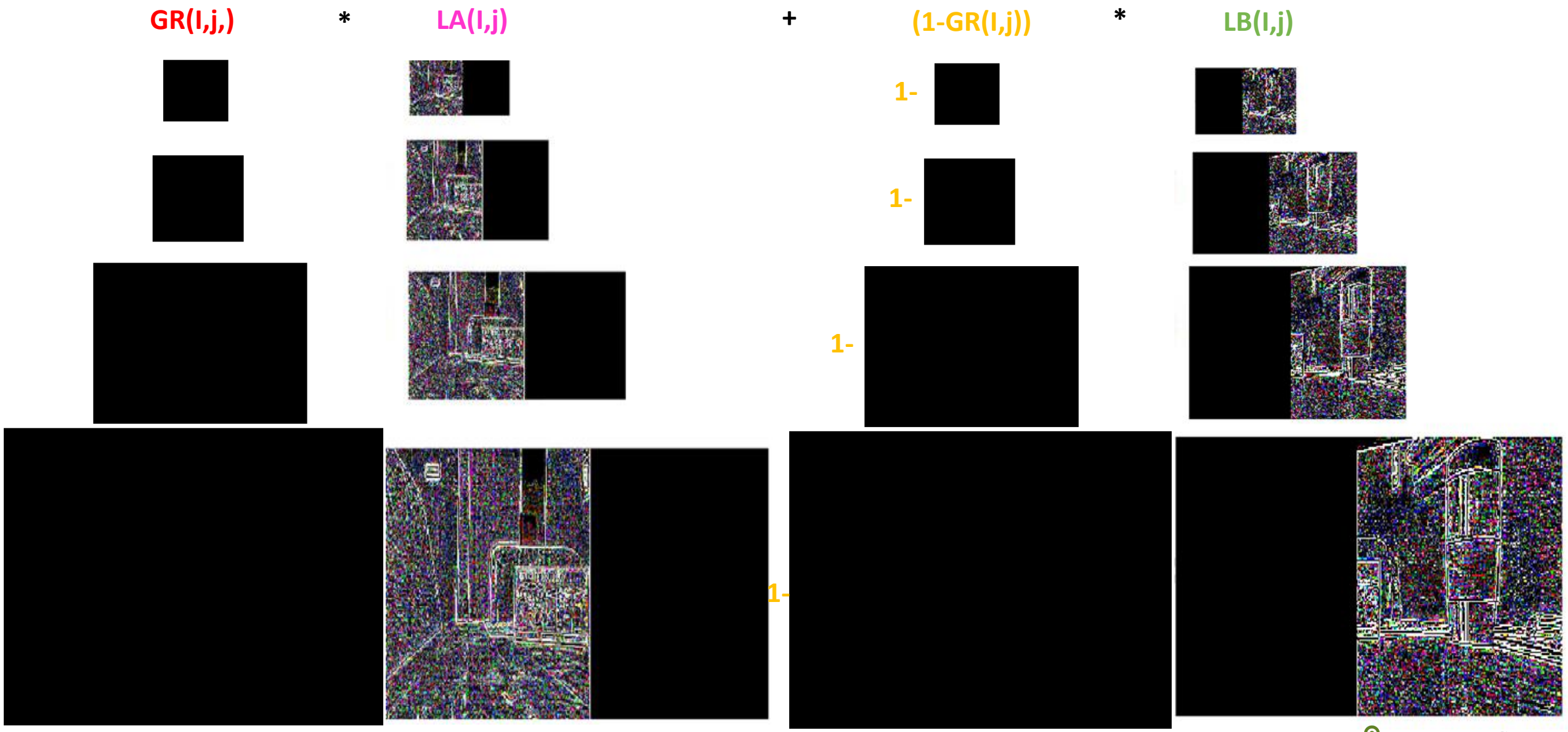
Gaussian Pyramid of the Mask



Blending: Form a combined pyramid from LA and LB

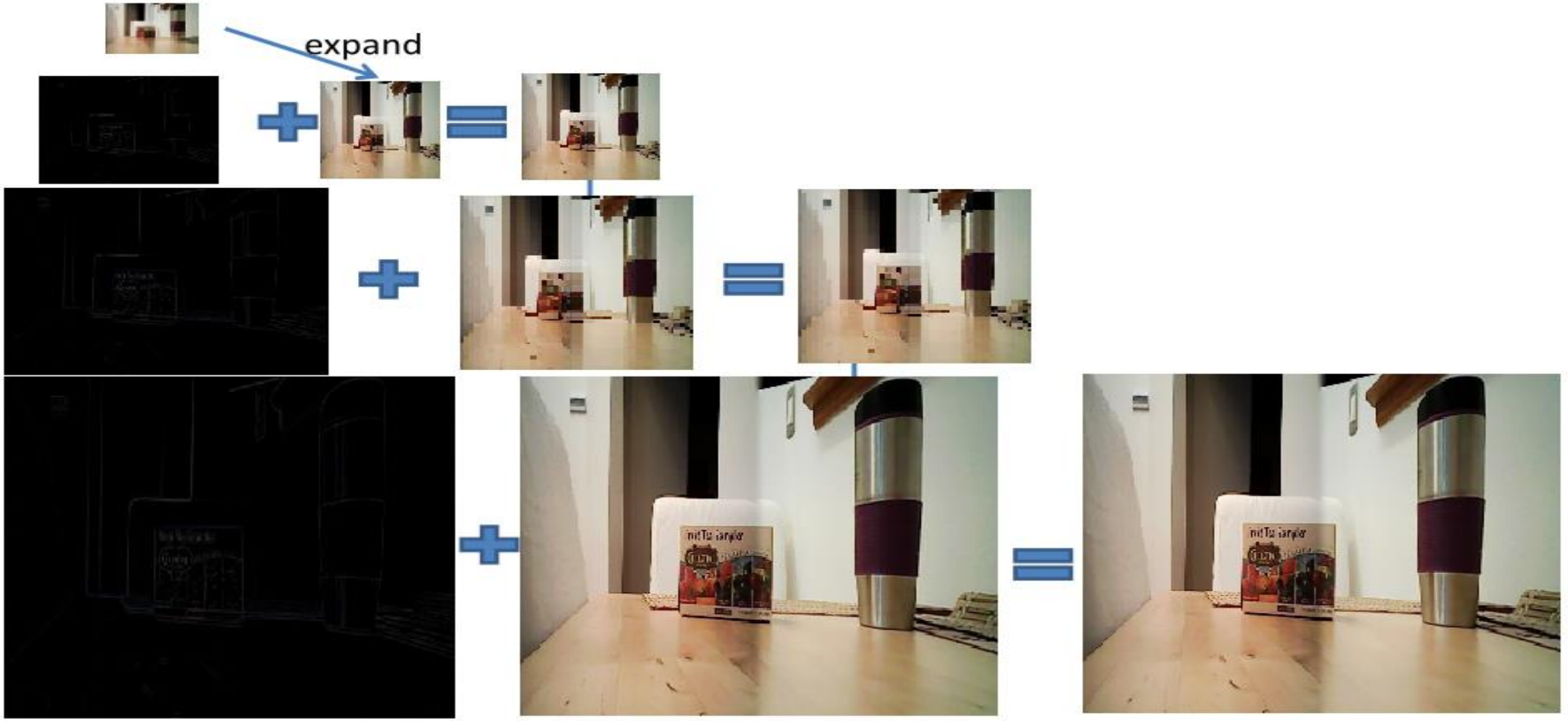
LS(i,j) = GR(I,j,) * LA(I,j) + (1-GR(I,j)) * LB(I,j)

GR(I,j,) * LA(I,j) + (1-GR(I,j)) * LB(I,j)



Reconstruct LS pyramid to get the final blended image

LS(i,j)



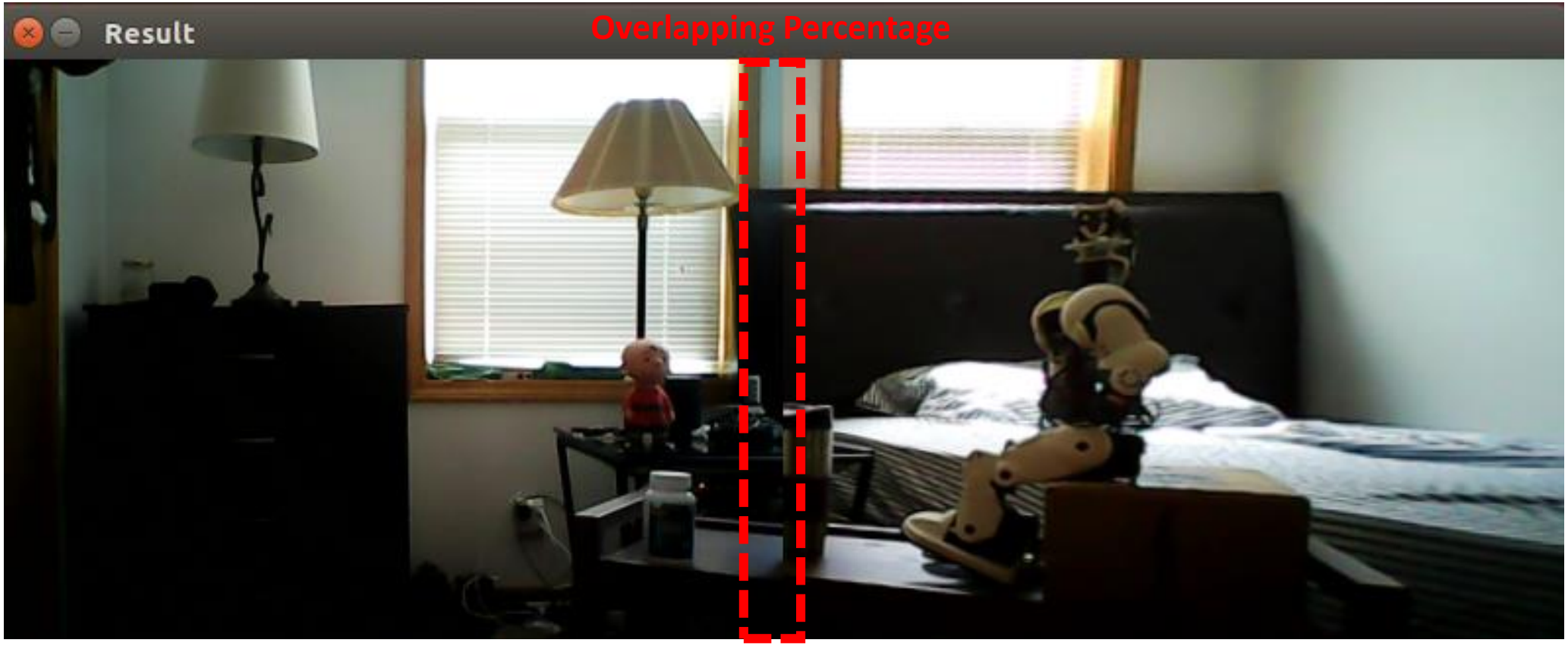
Pyramid Blended Image

Step 5 – Cropping (Optional)

Portland State UNIVERSITY

What if we don’t use any blending

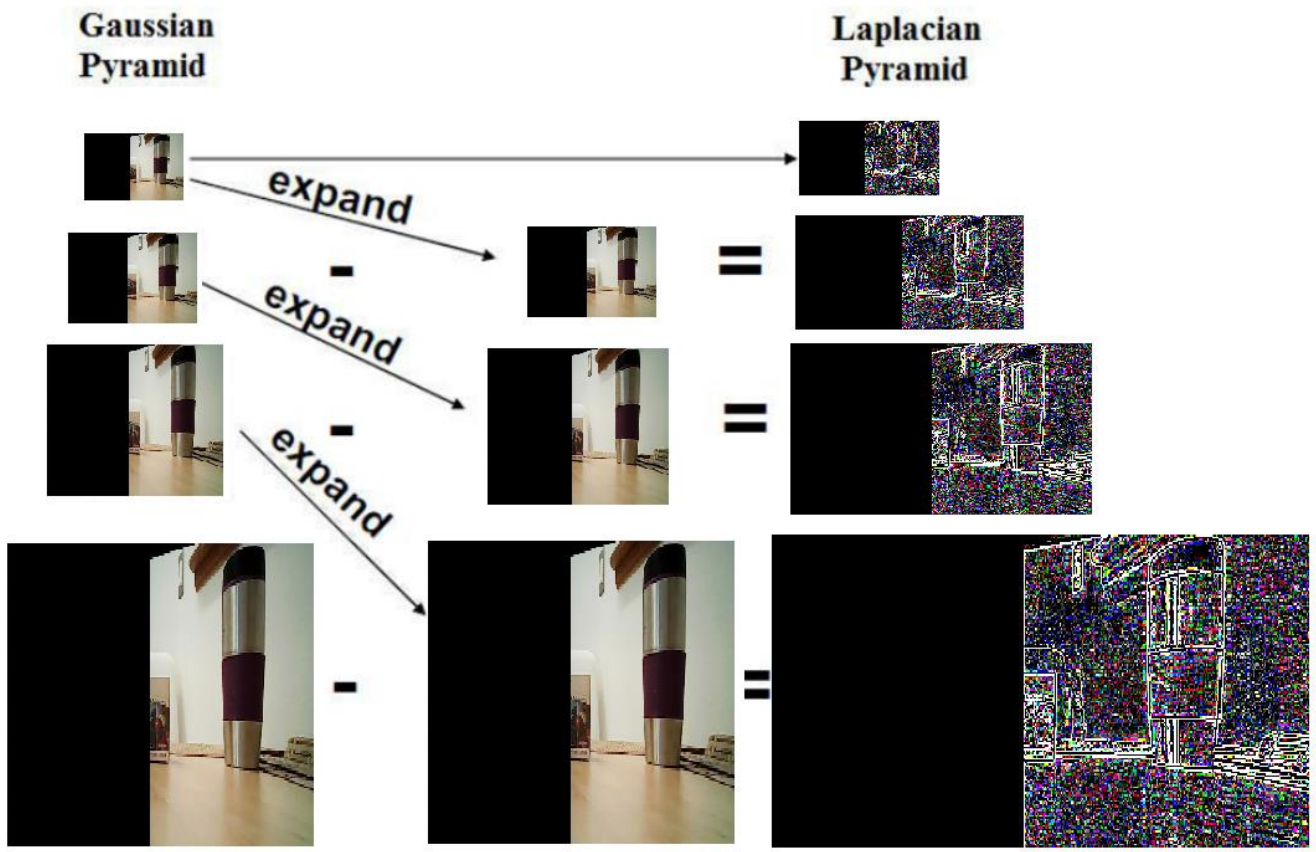
Challenges



Portland State UNIVERSITY

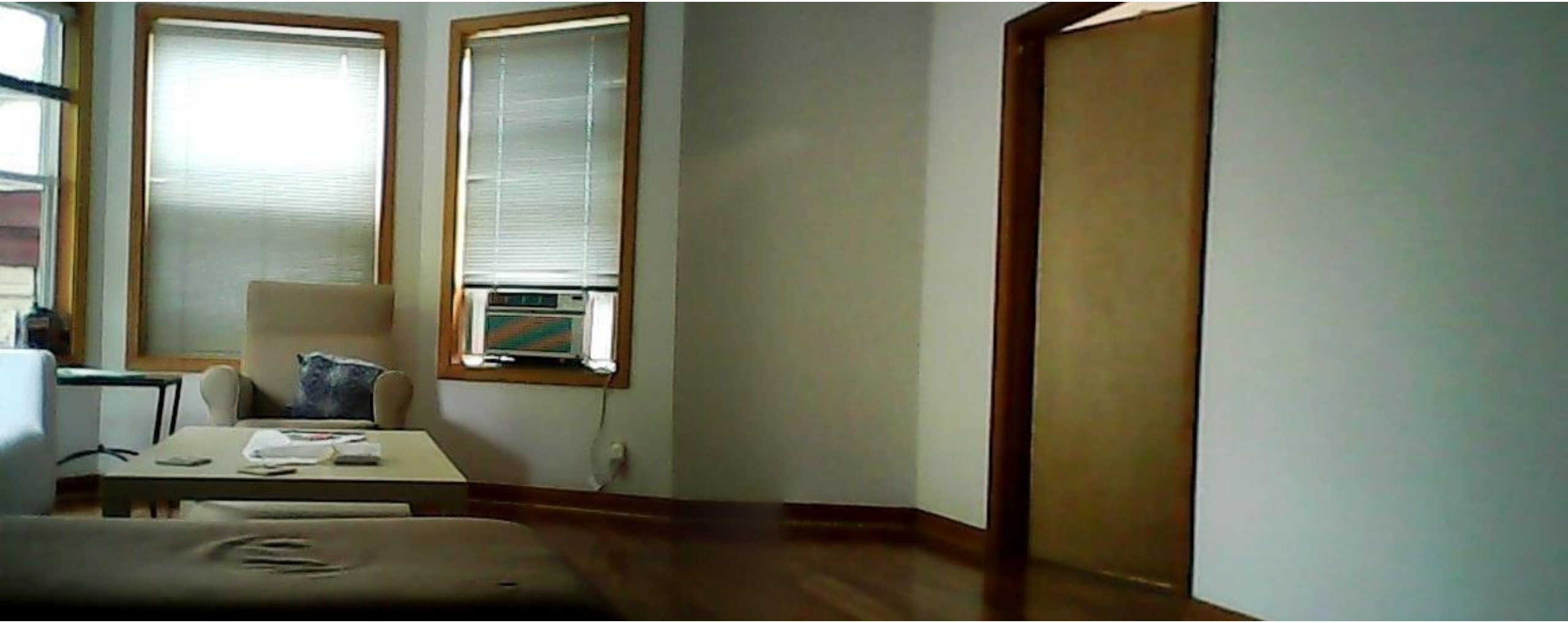
Challenges

Odd image size values



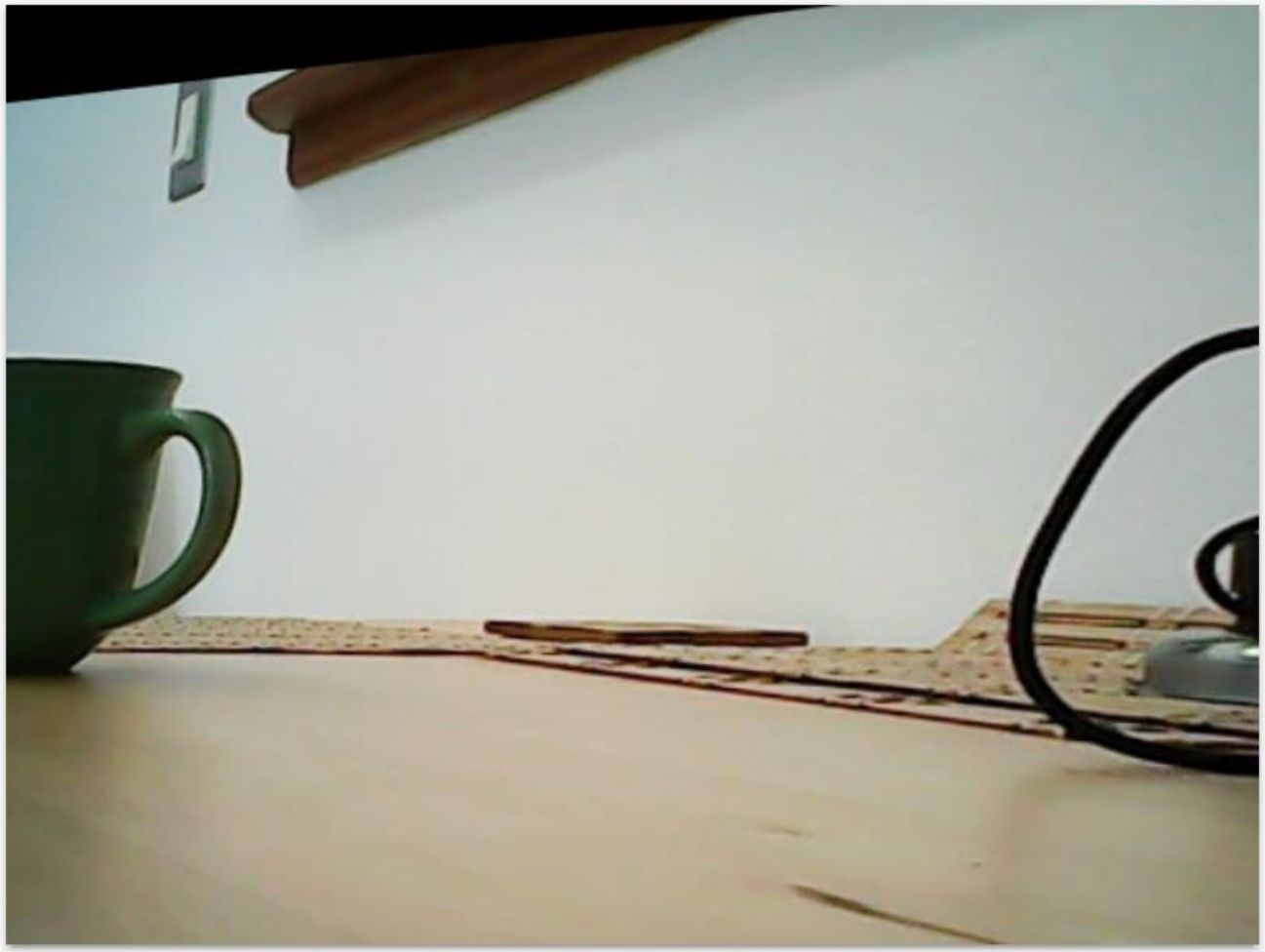
Final Results


Fruit Tea Sampler
CELESTIAL
HERBAL TEA



Object Detection

Google Cloud Vision API with Standard Image



r3.jpg

Table	80%
Furniture	64%
Wood	62%
Floor	62%
Lamp	54%
Light Fixture	51%

Google Cloud Vision API with Panoramic Image

result3.jpg

Table	83%
Cup	82%
Floor	81%
Coffee Cup	75%
Ceramic	75%
Flooring	71%
Tableware	68%
Furniture	65%

Future Work

- Adding eye cameras into the head
- More object detection testing with two eyes
- ROS implementation

Sources

- http://www.cvl.isy.liu.se/en/research/datasets/passta/
- https://web.stanford.edu/class/ee368/Handouts/Lectures/2015_Autumn/12-MonoPanorama_16x9.pdf
- https://www.pyimagesearch.com/2016/01/11/opencv-panorama-stitching/
- http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.206.5135&rep=rep1&type=pdf
- https://www.youtube.com/watch?v=oT9c_LlFBqs&t=2736s
- https://www.youtube.com/watch?v=E1--wyeSK_I

Questions