HYBRID IMAGES

Presenter: Angelic Phan

CS 410: Computer Vision, Winter 2019

Outline

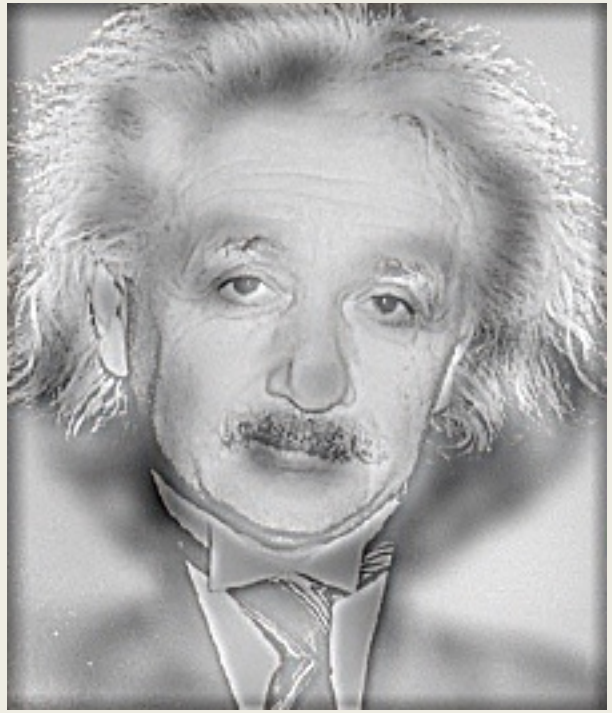
- Project Ideation
- Background
- Methodology
- Results/Examples
- Works Cited

Project Ideation

- Paper: Oliva, Aude, Antonio Torralba & Phillippe G. Schyns. “Hybrid Images”, SIGGRAPH, 2006, http://cvcl.mit.edu/publications/OlivaTorralb_Hybrid_Siggraph06.pdf
  - Hybrid Images Gallery: http://cvcl.mit.edu/hybrid_gallery/gallery.html

Background

- Hybrid Image
  - *An image whose interpretation depends on the spatial distance as to which you are observing the image*
  - *Comprised of two different images*
    - Low-frequency image
    - High-frequency image

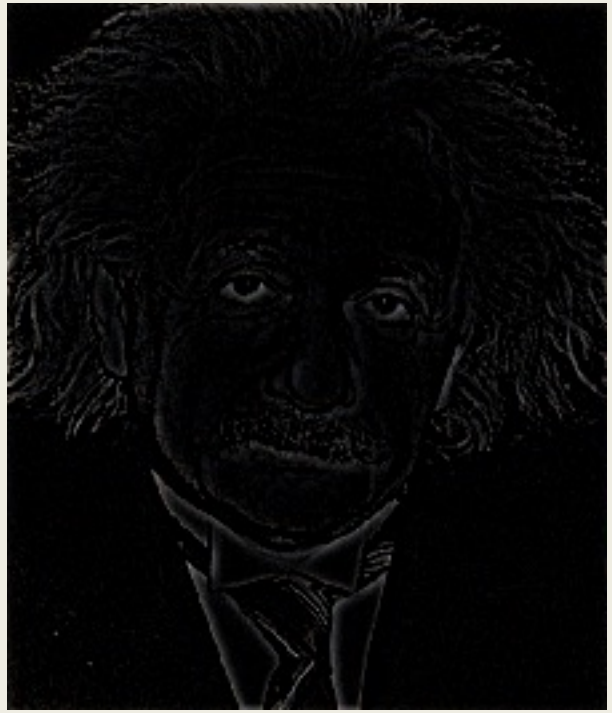


Background

- Low-frequency image
  - *An image that has been filtered with a low-pass filter to get rid of the object details*
    - Gaussian filter
  - *This image is seen from further away in a hybrid image*

Background

- High-frequency image
  - *An image that has been filtered with a high-pass filter to enhance the edges of the object*
    - Laplacian filter
  - *This image is seen from up close in a hybrid image*



Methodology: spatial

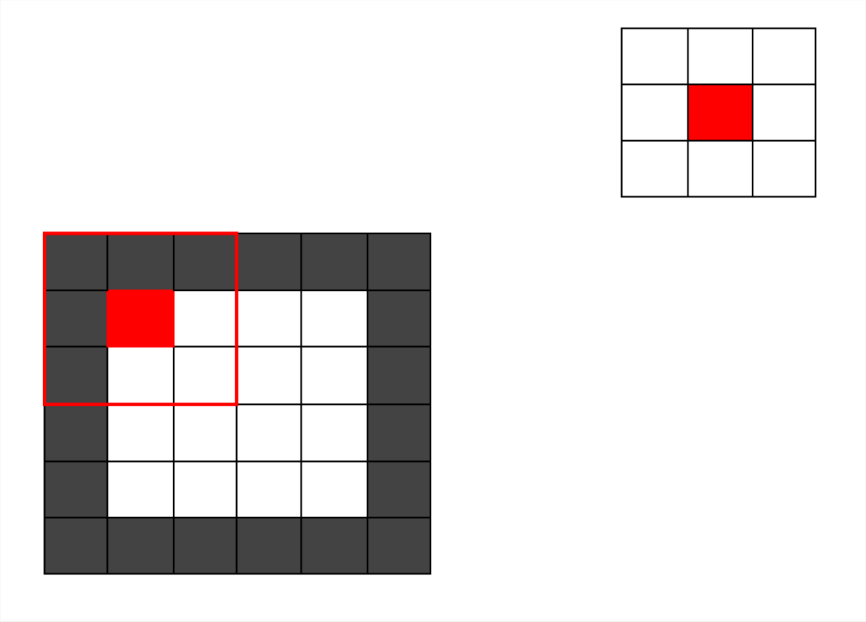
- Gaussian Matrix
  - *Filter size: $2\sigma + 1$ x $2\sigma + 1$*
  - *Equation:*

$$G_\sigma = \frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$$

    - x: x value of the center element in the matrix; round((2σ + 1) / 2)
    - y: y value of the center element in the matrix; round((2σ + 1) / 2)
  - *Convolution: apply equation to every element in the filtering matrix*
  - *Normalize: divide each element by the sum of all the elements*

Methodology: spatial domain

- Gaussian/low-frequency image
  - *Apply the filtering matrix to the input image through convolution*



Methodology: spatial domain

- Gaussian/low-frequency image
  - *Apply the filtering matrix to the input image through convolution*
- Laplacian/high-frequency image
  - *High-frequency image = original image – low-frequency image*

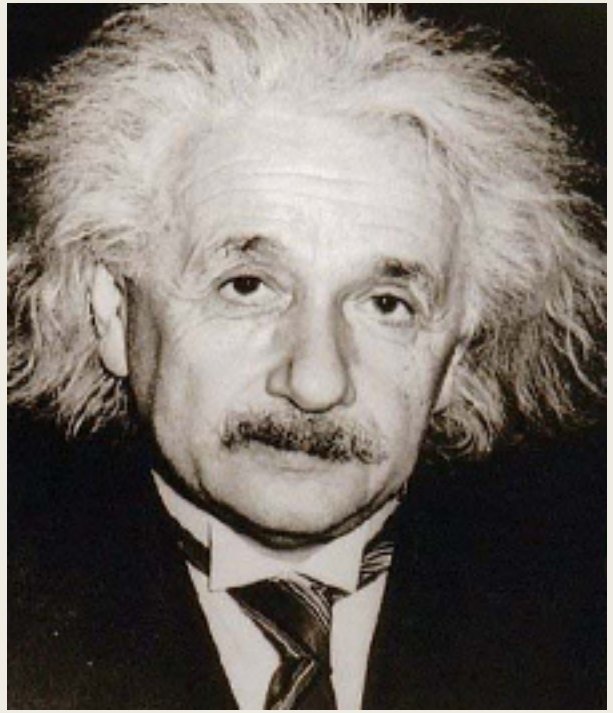
Methodology: spatial domain

- Gaussian/low-frequency image
  - *Apply the filtering matrix to the input image through convolution*
- Laplacian/high-frequency image
  - *High-frequency image = original image – low-frequency image*
- Note: Use two different sigma values to obtain two different gaussian filters
  - *One for the low-frequency image*
  - *One for the high-frequency image*

Methodology: spatial domain

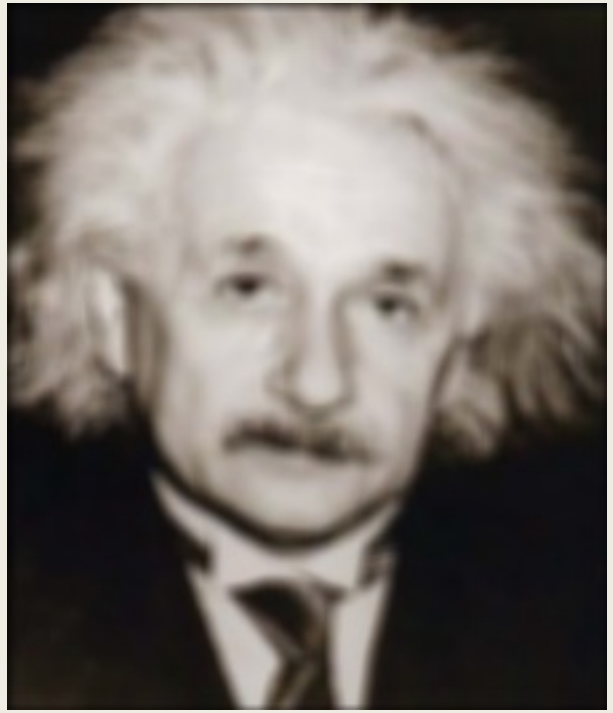
- Gaussian/low-frequency image
  - *Apply the filtering matrix to the input image through convolution*
- Laplacian/high-frequency image
  - *High-frequency image = original image – low-frequency image*
- Note: Use two different sigma values to obtain two different gaussian filters
  - *One for the low-frequency image*
  - *One for the high-frequency image*
- Hybrid image
  - *Hybrid image = low-frequency image + high-frequency image*

Methodology



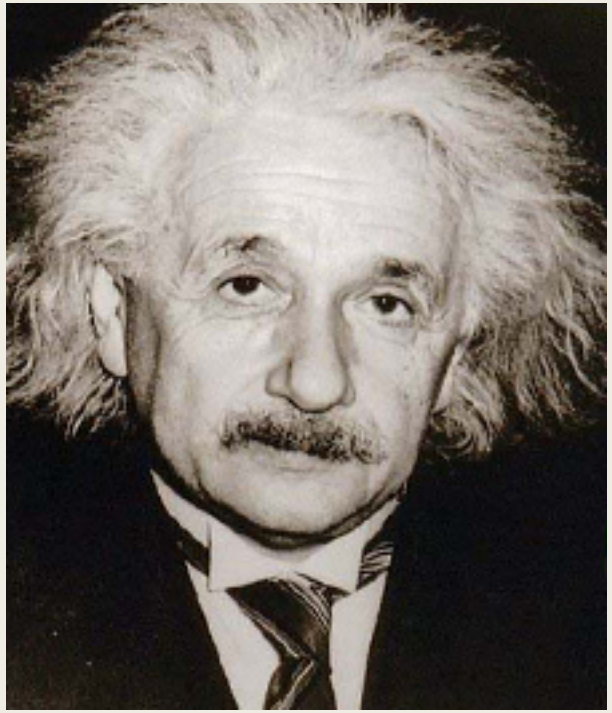
Methodology

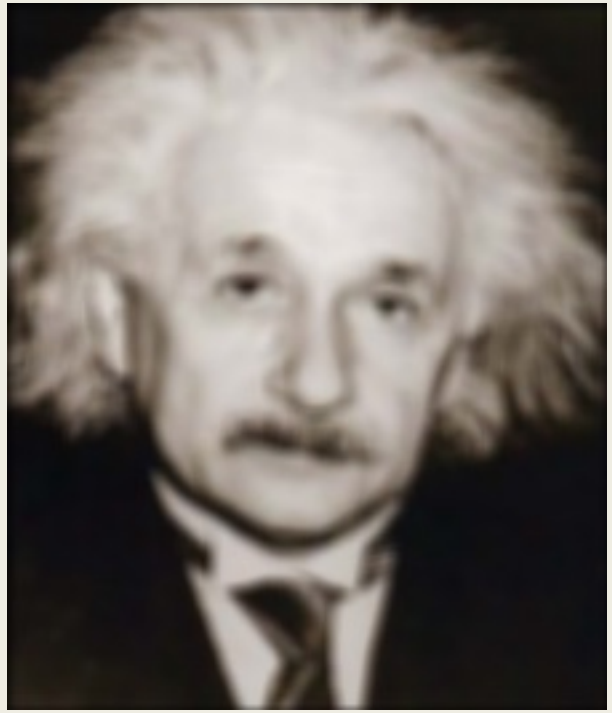
$\sigma = 7$



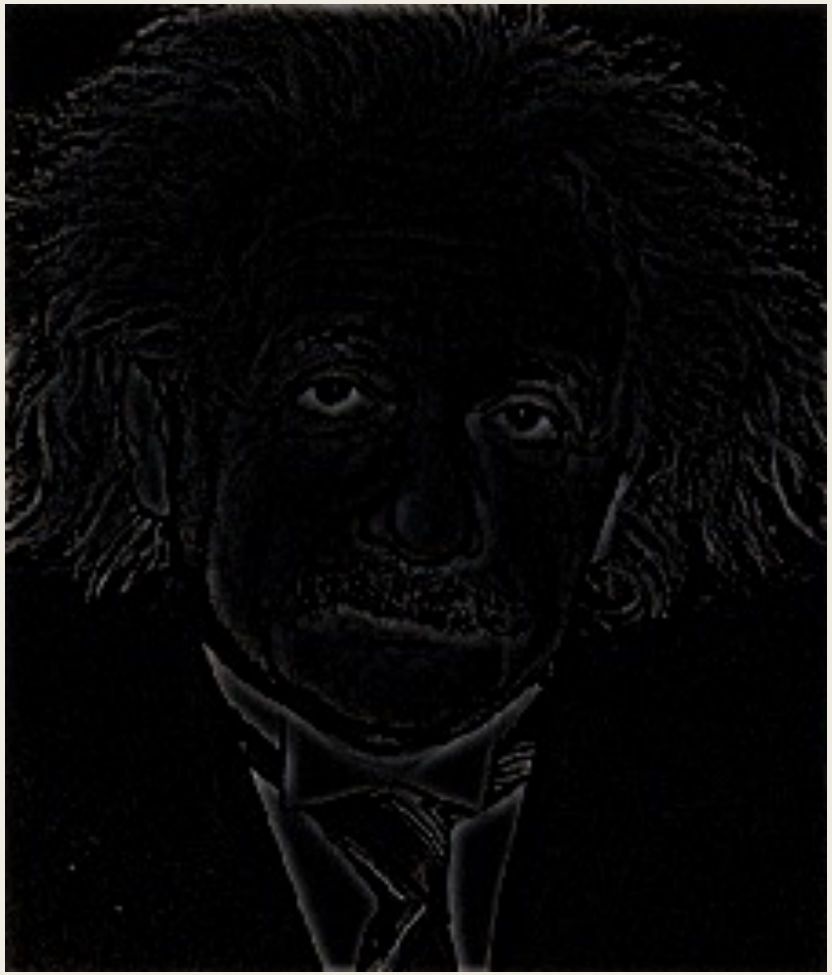
$\sigma = 3$

Methodology



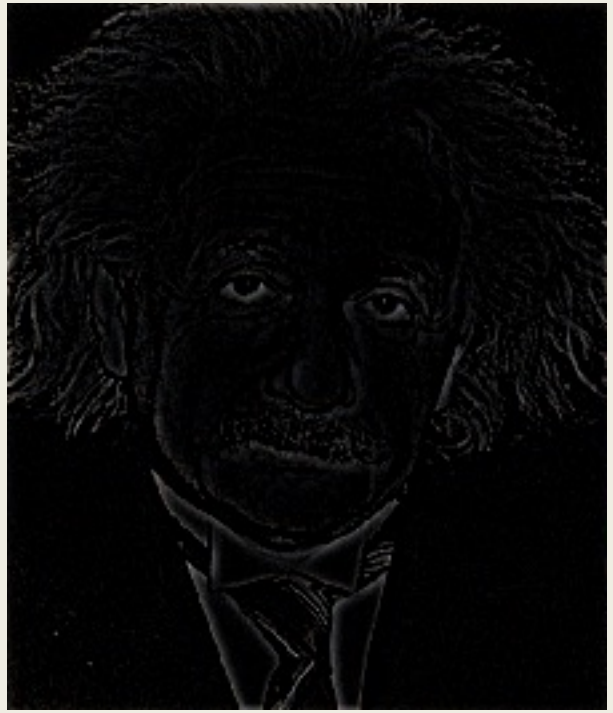


Methodology

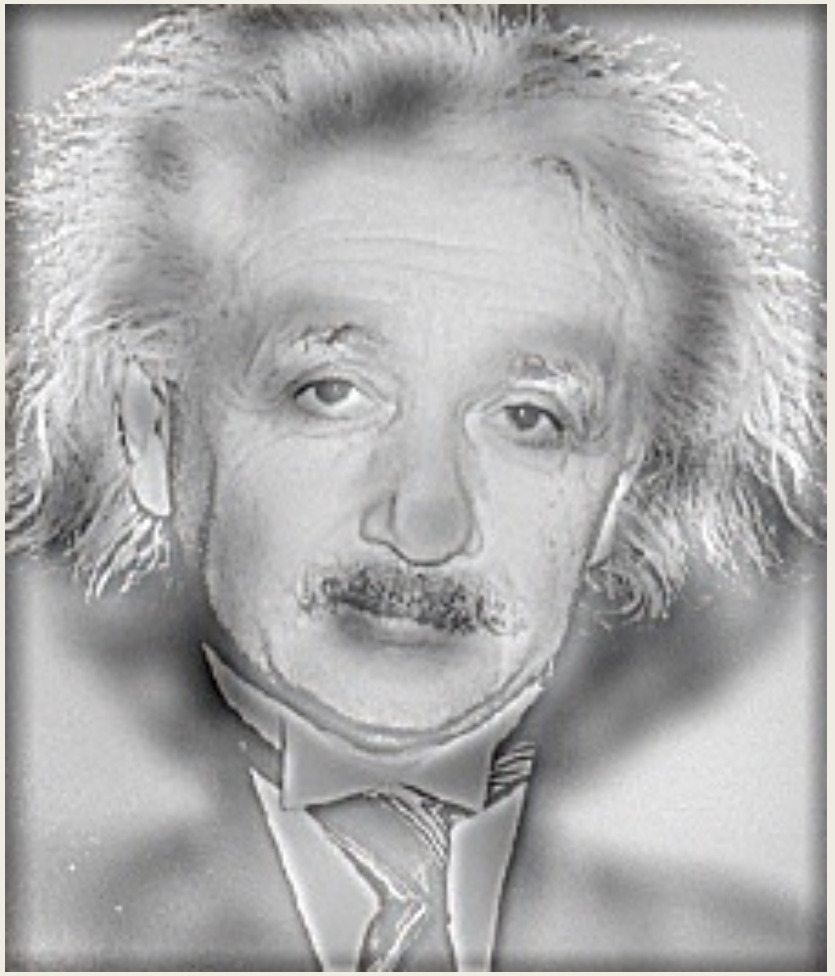


Metodology

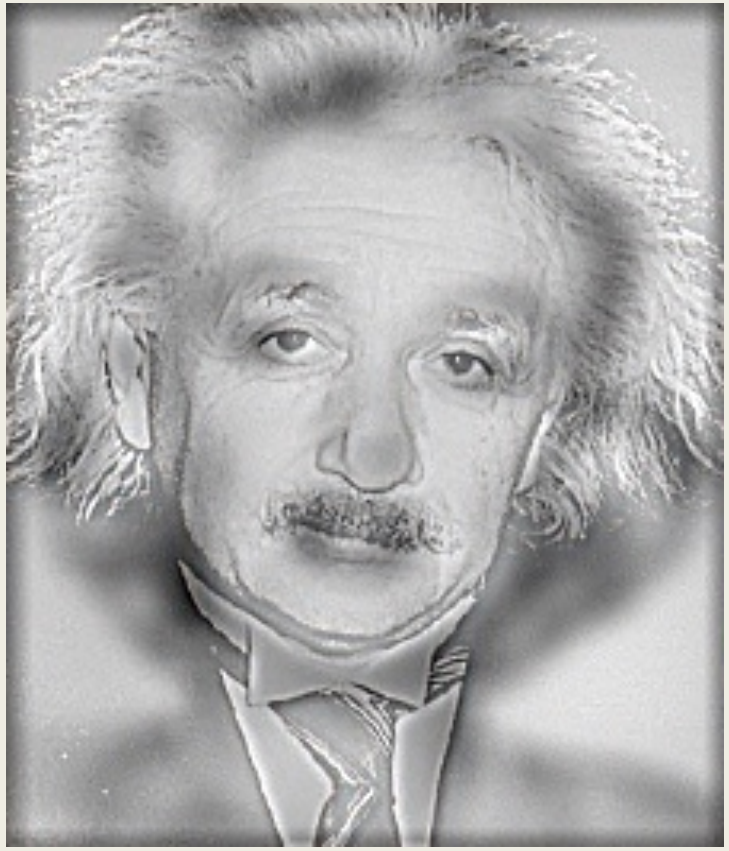
+



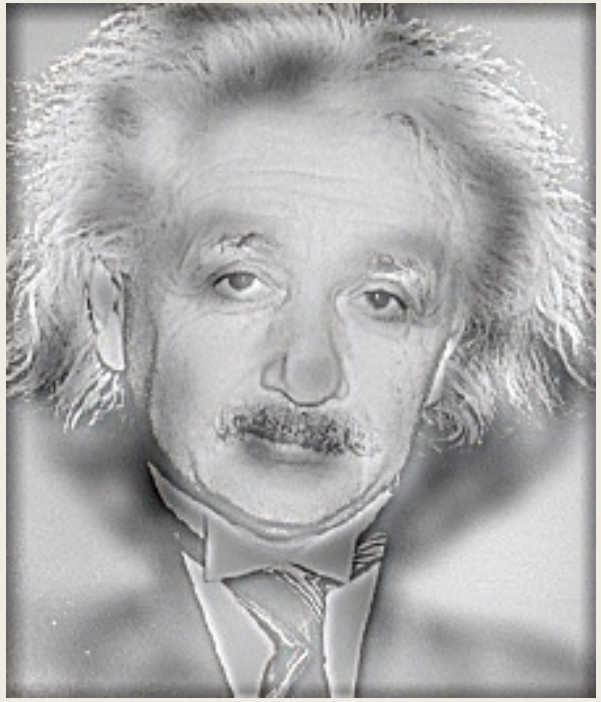
Results



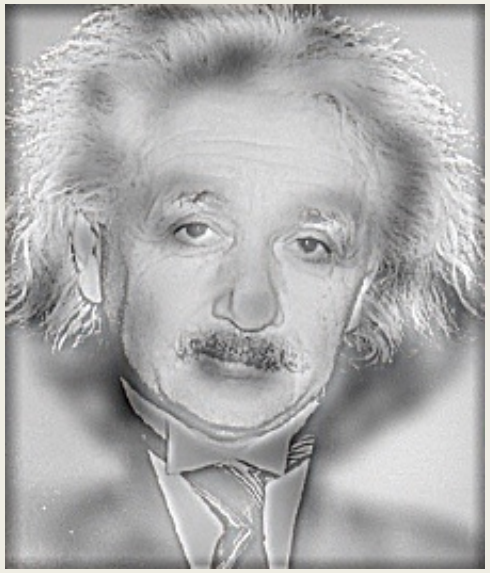
Results



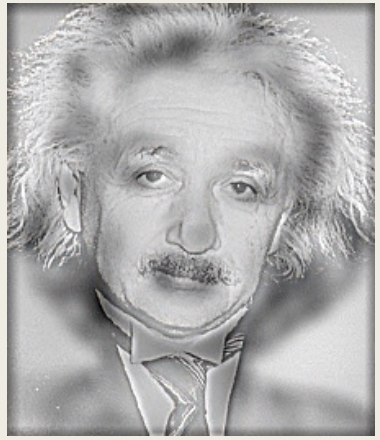
Results



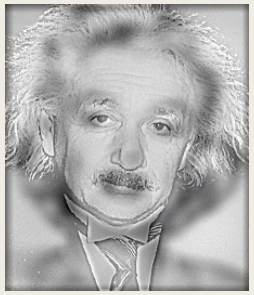
Results



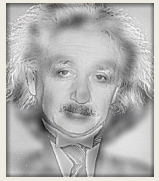
Results



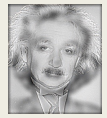
Results



Results

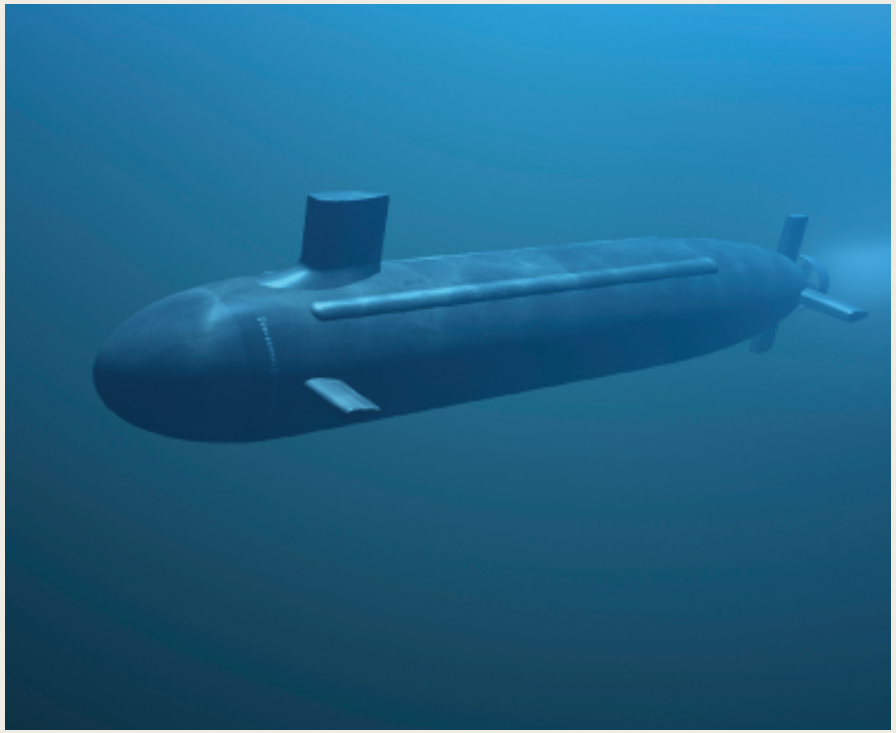


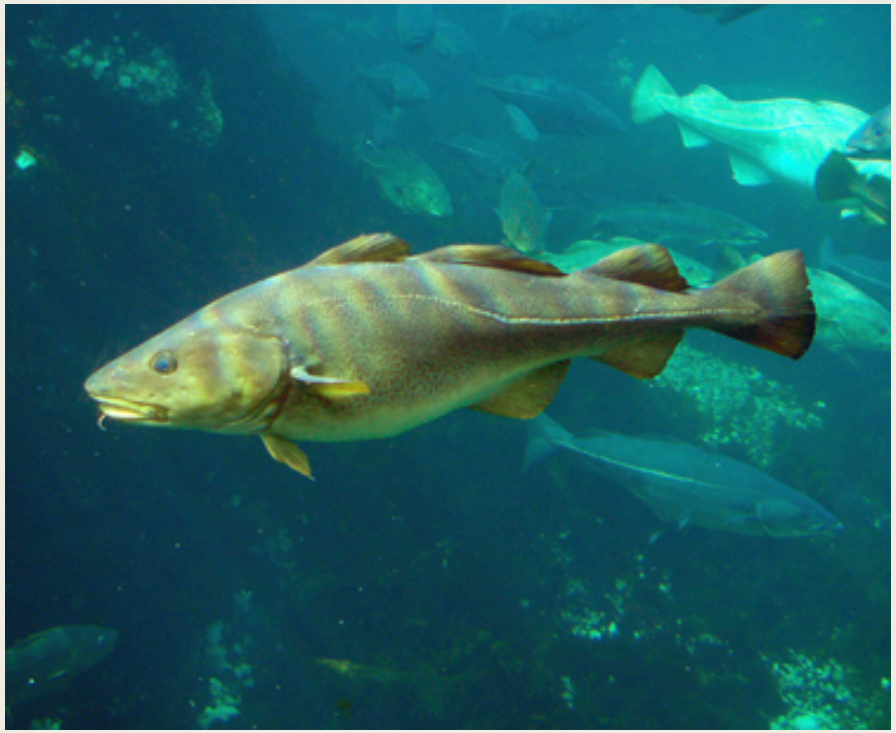
Results



Results

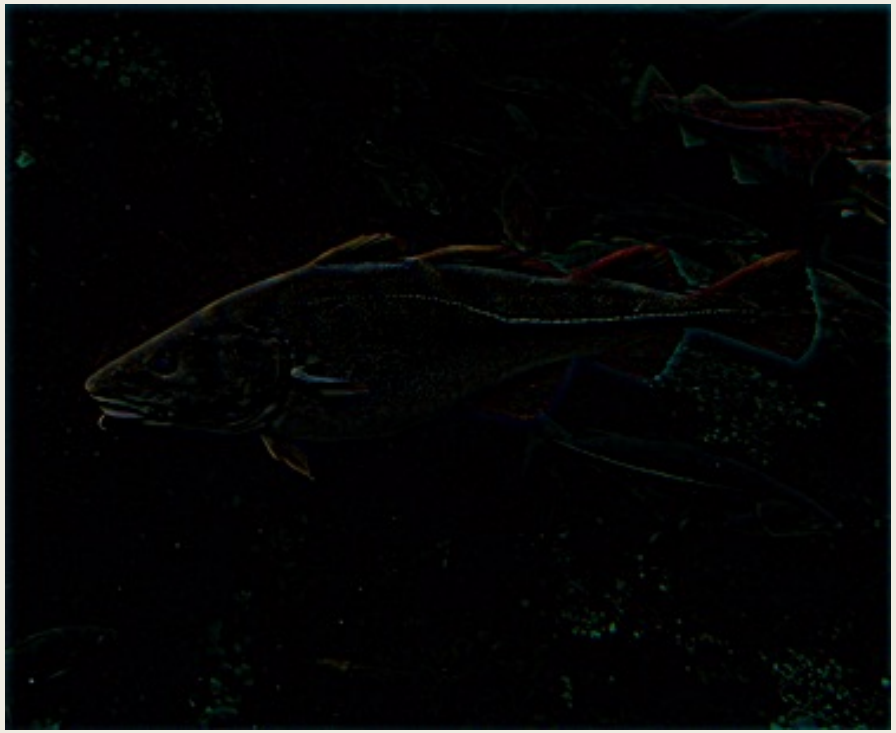
Example





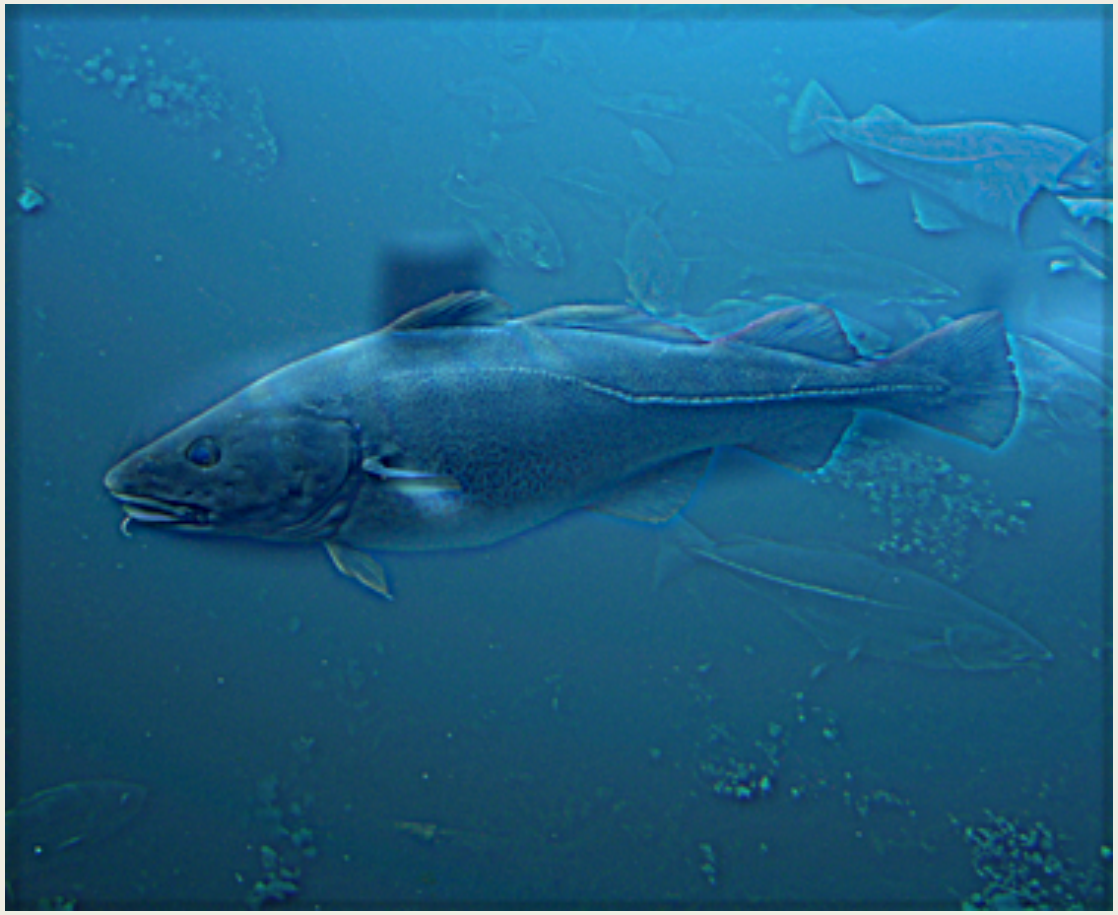
Result

$\sigma = 5$

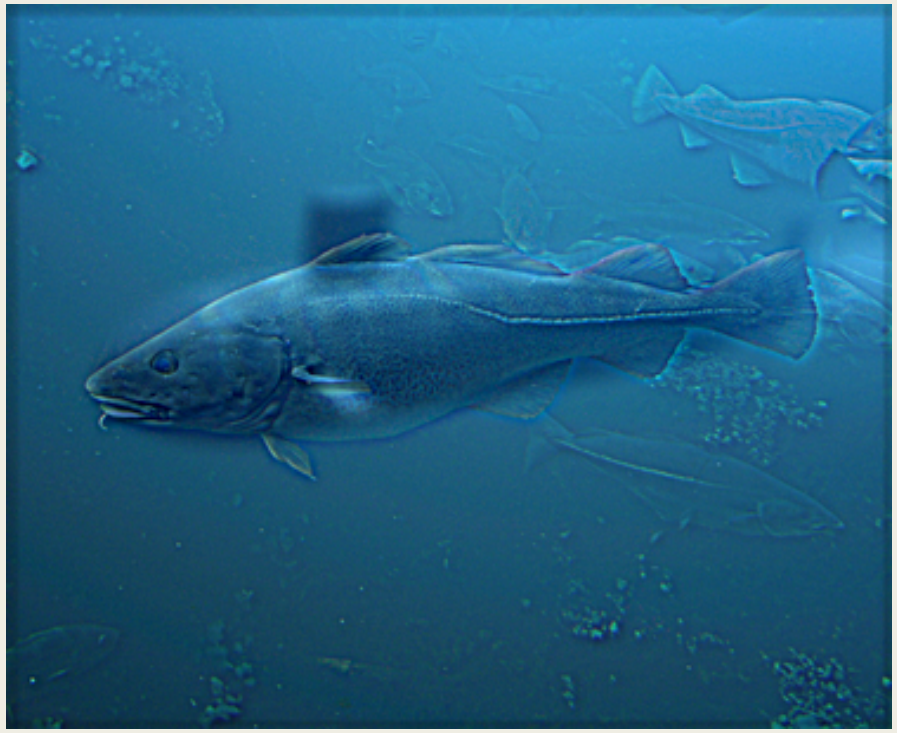


$\sigma = 3$

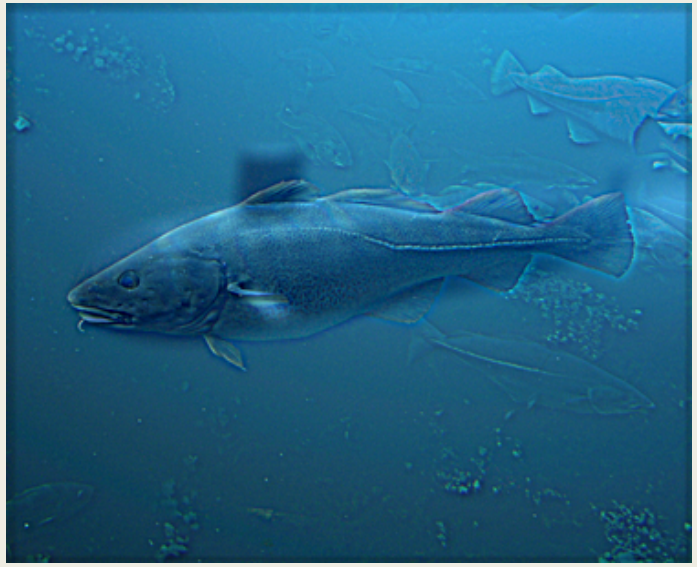
Results



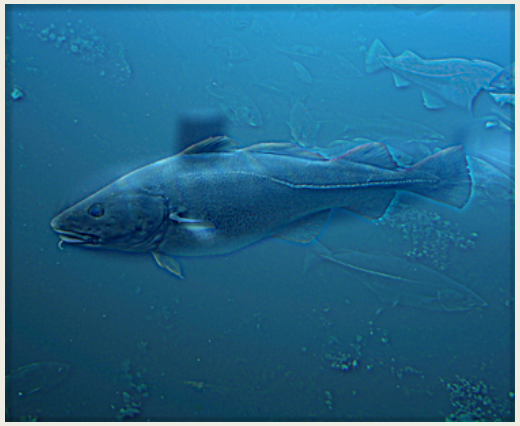
Results



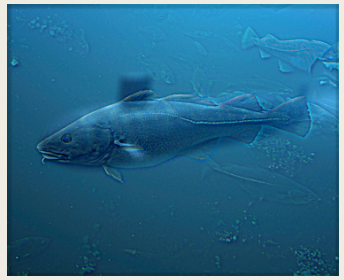
Results



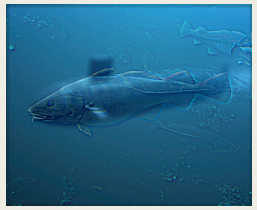
Results



Results



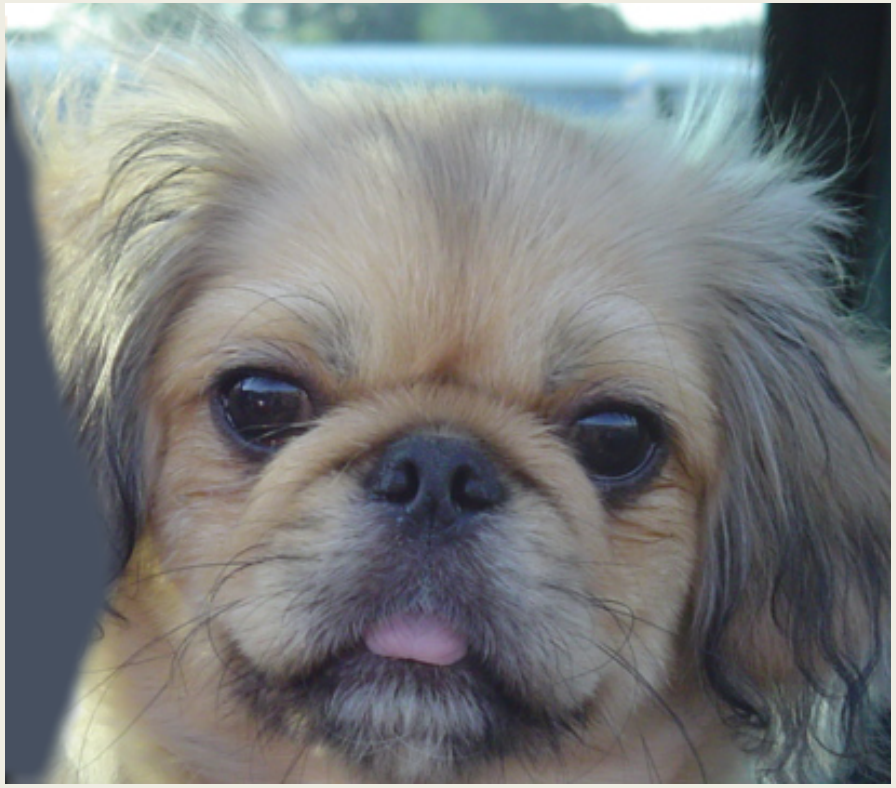
Results



Results

Results

Example



Result

σ = 13

σ = 7

Results

Works Cited

- Liu, Feng. “Introduction to Visual Computing: Lecture 2”, 2019, http://web.cecs.pdx.edu/~fliu/courses/cs410/notes/Lecture2.pdf. Accessed February 7 2019.
- Oliva, Aude, Antonio Torralba & Phillippe G. Schyns. “Hybrid Images gallery”, Massachusetts Institute of Technology http://cvcl.mit.edu/hybrid_gallery/gallery.html. Accessed February 7 2019.
- Oliva, Aude, Antonio Torralba & Phillippe G. Schyns. “Hybrid Images”, SIGGRAPH, 2006, http://cvcl.mit.edu/publications/OlivaTorralb_Hybrid_Siggraph06.pdf. Accessed February 7 2019.
- Mian, Ajmal. “CITS4402 Computer Vision: Week 4 Laboratory Exercises”, The University of Western Australia, http://teaching.csse.uwa.edu.au/units/CITS4402/labs/week3/week3.html. Accessed February 28 2019.
- Unknown. “Project 1: Image Filtering and Hybrid Images”, Georgia Tech, https://www.cc.gatech.edu/~hays/compvision/proj1/. Accessed February 7 2019.

THANK YOU