

Image Filtering with Built-in MatDeck Functions

There are several built in functions used for image filtering and processing in MatDeck. In this example, we illustrate the uses and effects of these functions on a selected test image.

Median Filter

The median filter can be used to remove noise from an image. A median filter is a filter that takes the median of the current pixel and its neighbors. The median is obtained by sorting all the values from low to high, and then taking the value in the center. A sliding window of size $M \times N$ is used on each channel (Red, Green and Blue) separately and the elements in the window are sorted, the middle element from the sorted array is then chosen. A median filter gives better results to remove salt and pepper noise from the image, and it completely eliminates the noise. The resulting image is not blurred as in the case of mean filter, but it does reduce the image quality. The median filter function in MatDeck is `image median()`. The median filter can not be implemented using box filtering, and it is implemented as a independent image filtering function in MatDeck. It's arguments are the image that is to be filtered, width and height of the neighbor to take the median. Here is an example of how the filter is used and it's results. We take the test image corrupted with salt and pepper noise, and we then remove the noise by utilizing the median filter.

```
1 img := image read("peppers.png")
2 imgf := image median(img, [3; 3])
3 pic := image widget(0, img)
4 pic1 := image widget(0, imgf)
```

The image in this example has high resolution, because of that smaller versions are displayed here.

```
5 set size(pic, 340, 260)
6 set size(pic1, 340, 260)
```



Sharpen Image

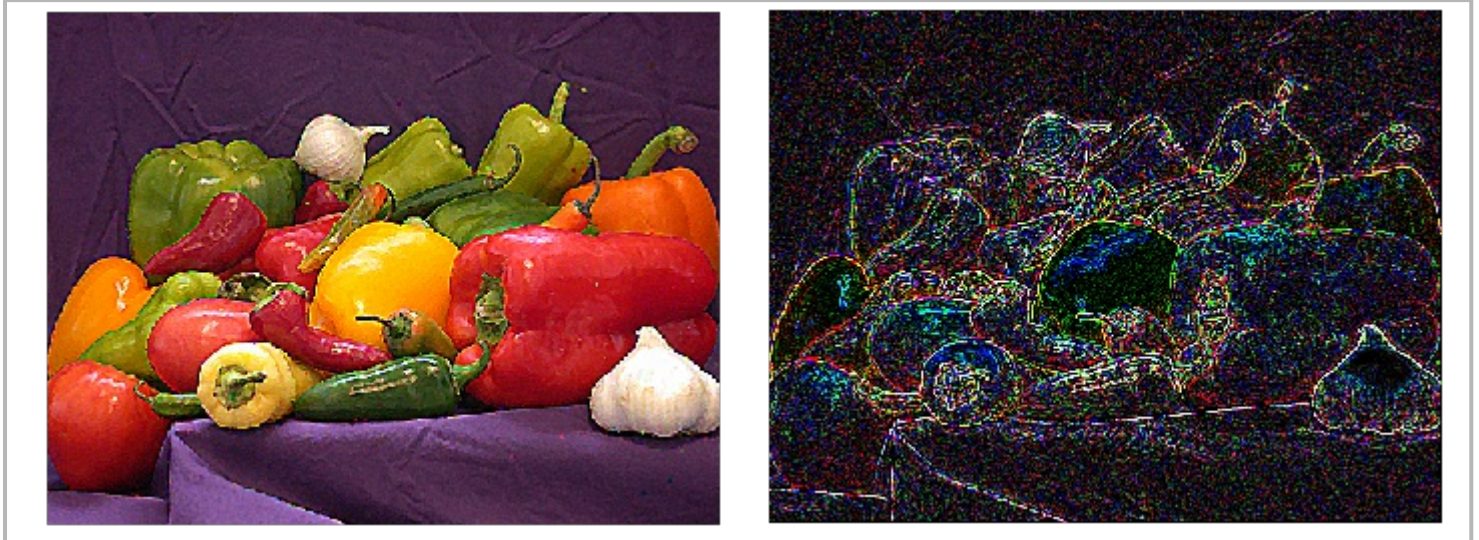
We can see that the median filter 3 by 3 pixels is very effective in noise removal. However, the edges in the filtered image are not sharp. We can try to sharpen the image by using the built in function `image sharpen()`.

```
7 imgs := image sharpen(imgf)
8 pic2 := image widget(0, imgs)
9 set size(pic2, 340, 260)
```

Edge Detection

In MatDeck, there is `image edge()` function which can be used to detect edges in the image. We will apply the image edge detection on the image obtained in the previous step after sharpening.

```
10  imge := image edge(imgs)
11  pic3 := image widget(0, imge)
12  set size(pic3, 340, 260)
```



Smooth and Motion Blur

There are two additional built-in image functions. The function `image smooth()` softens the edges in the image, while `image mblur()` adds motion blur to the image. Here are the examples applied on the filtered image after the median filter.

```
13  imgsm := image smooth(imgf)
14  pic4 := image widget(0, imgsm)
15  set size(pic4, 340, 260)
16  imgb := image mblur(imgf)
17  pic5 := image widget(0, imgb)
18  set size(pic5, 340, 260)
```



Finally, we can try the image raised effect on the above image.

```
19 imgr := image raised(imgf)
20 pic6 := image widget(0, imgr)
21 set size(pic6, 340, 260)
```

