```
% BME671L Lab #8: conv, conv2

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close all, clear all;
```
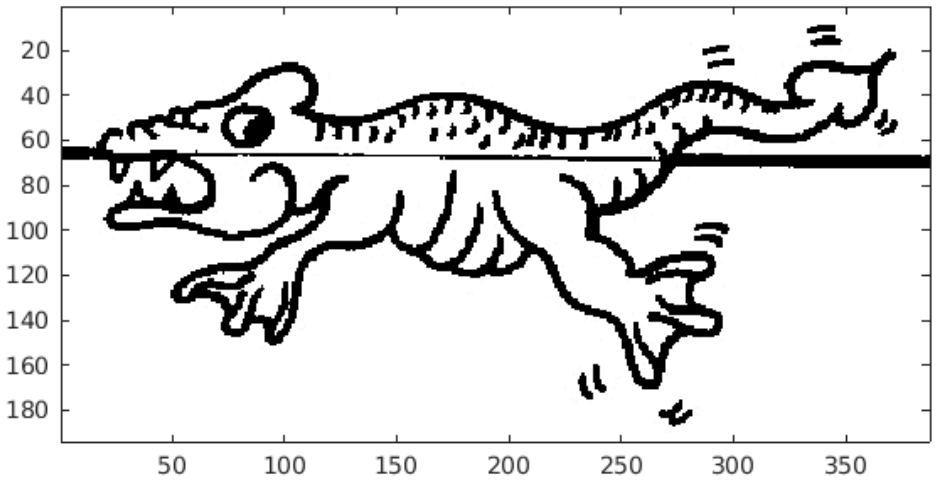

Q1: Use 'imread' command to read file 'dragon.jpg' into array A and display A using 'image'. Set the axis so that the image is not distorted. Set colormap to 'gray(256)' and add colorbar and the title.

```
figure(1), clf;
A = imread('dragon.jpg');
image(A);
axis image;
colormap gray(256);
```



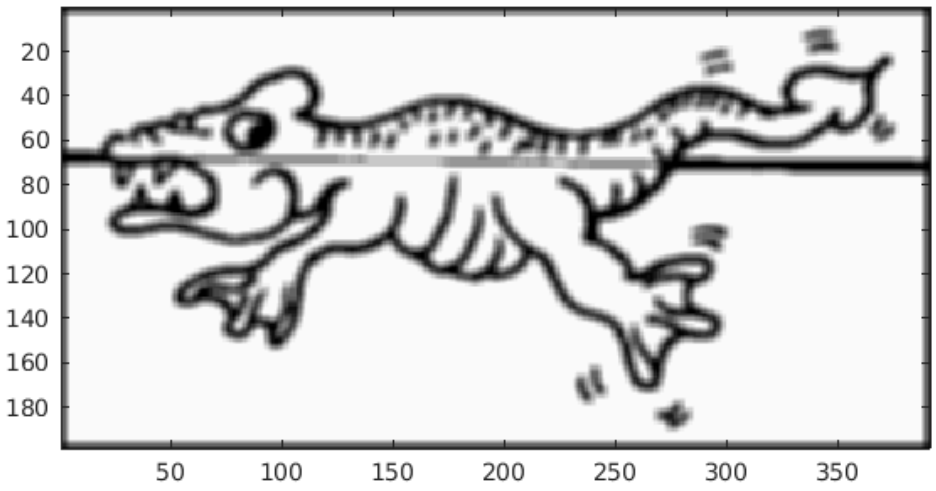
Q2: Define vector f5 that will hold impulse response of a 5-pt averager:

```
% y[n] = (x[n] + x[n-1] + x[n-2] + x[n-3] + x[n-4])/5
f5 = [1/5 1/5 1/5 1/5 1/5];
```

Q3: Use 'conv2' to apply 5-pt averager for ROWS and COLUMNS of image A. Display the result as an image.

```
figure(2), clf;
A_conv = conv2(f5, f5, A);
image(A_conv);
```

```
axis image;
colormap gray(256);

% ************************************************************************
% SHOW YOUR IMAGE FOR Q3 TO THE TA TO RECEIVE CREDIT FOR THE LAB IF
 YOU
% ARE NOT PRESENT AT THE DISCUSSION SESSION ON FRIDAY.
% ************************************************************************
```



Q4: State what the 5-pt averages does to the image. Does this filter accentuate low or high frequencies? Explain.

```
% YOUR ANSWER:
% The five point filter smooths/blurs the image. It makes the high
 frequency
% component subtle and intensifies the low frequency components.
 Therefore the image
% is blurry or smoothened.
```

Q5: The 5-point averager adds a thin dark frame to the image. Explain why this frame is added and why it is dark. Hint: zoom in on this frame.

```
% YOUR ANSWER:
% The convolution operation on the edge of the image will add zero
 padding
% for the size of filters. So when the filter moves like a sliding
 window,
```

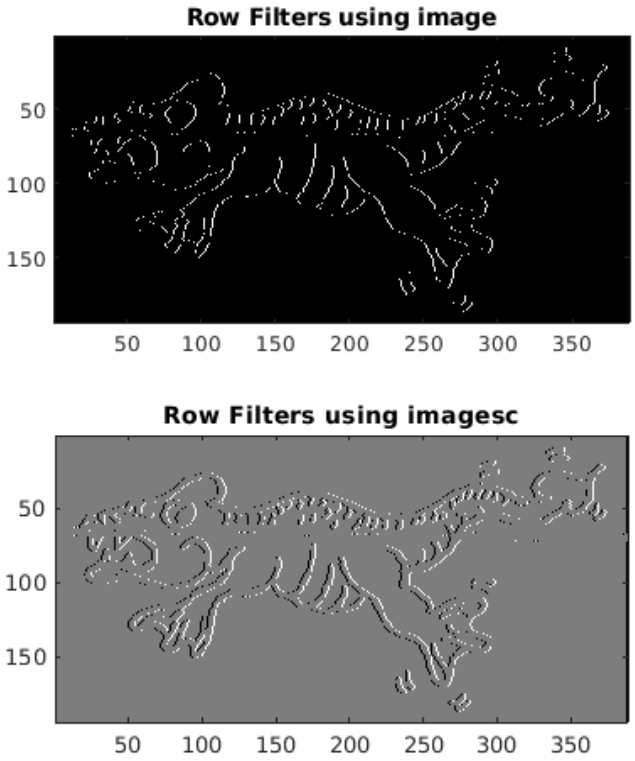
```
% the pixel value will increase eventually. Therefore, we see a dark
 line
% in the lateral edges of the image.
```

Q6: Define vector d1 that will hold impulse response of first-difference filter:

```
% y[n] = x[n] - x[n-1];
d1 = [1, -1];
```

Q7: Use 'conv2' to apply first-difference filter to ROWS only of image A. On the same figure use subplot to display the image using: * image (top image) * imagesc (bottom image)

```
figure(3), clf;
subplot(2, 1, 1);
A_d1 = conv2(A, d1);
image(A_d1);
axis image;
colormap gray(256);
title('Row Filters using image');

subplot(2, 1, 2);
imagesc(A_d1);
axis image;
colormap gray(256);
title('Row Filters using imagesc');
```

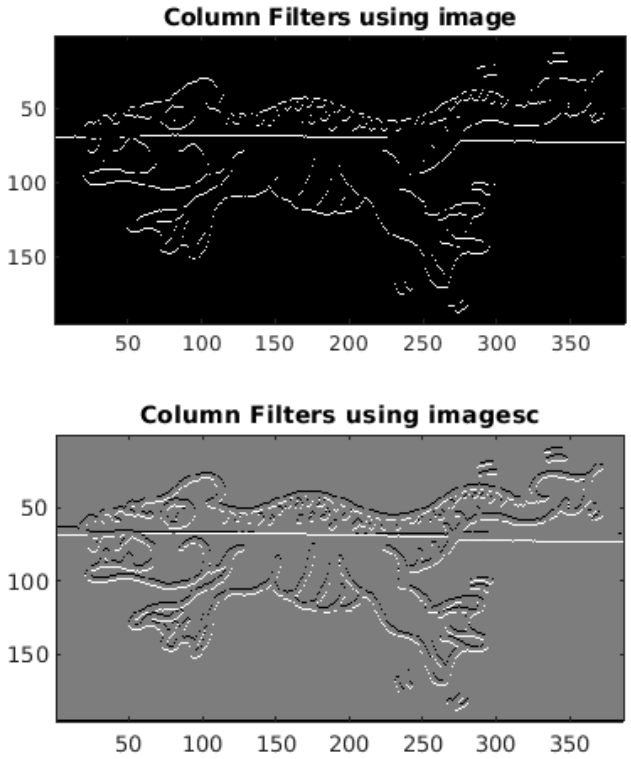


Q8: Explain the reason why the result of the first-difference filter looks different when it is displayed with 'image' and 'imagesc'.

```
% YOUR ANSWER:
% 'imagesc' scales the data linearly so full range of colors are
 observed
% without clipping, hence a gray scale image. In contrast, 'image'
 uses
% actual pixel values to plot the image and the color channels are
% in gray(256), so clipping of pixel value is observed and the image
% appears black and white.
```

Q9: Use 'conv2' to apply first-difference filter to COLUMNS only of image A. Display the result as an image.

```
d2 = transpose(d1);
figure(4), clf;
subplot(2, 1, 1);
A_d2 = conv2(A, d2);
image(A_d2);
axis image;
colormap gray(256);
title('Column Filters using image');

subplot(2, 1, 2);
imagesc(A_d2);
axis image;
colormap gray(256);
title('Column Filters using imagesc');
```



Q10: State what the first-difference filter does to the image. Does this filter accentuate low or high frequencies? Explain.

```
% YOUR ANSWER:
% First difference filter is an edge finding filter. It responds
 positively to
% increases in the signal and negatively to decreases in the signal.
% Adjacent input samples that are identical (or nearly identical),
% will cancel one another, causing the output to be zero.
```

When you are done:

```
% * upload your script to Sakai
%   * upload a pdf containing your script and outputs
```

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