Image Processing Lab Report

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Experiment 7 : Morphological Image Processing

a. **WAP to erode and dilate with structuring elements as circle and line on different images.**

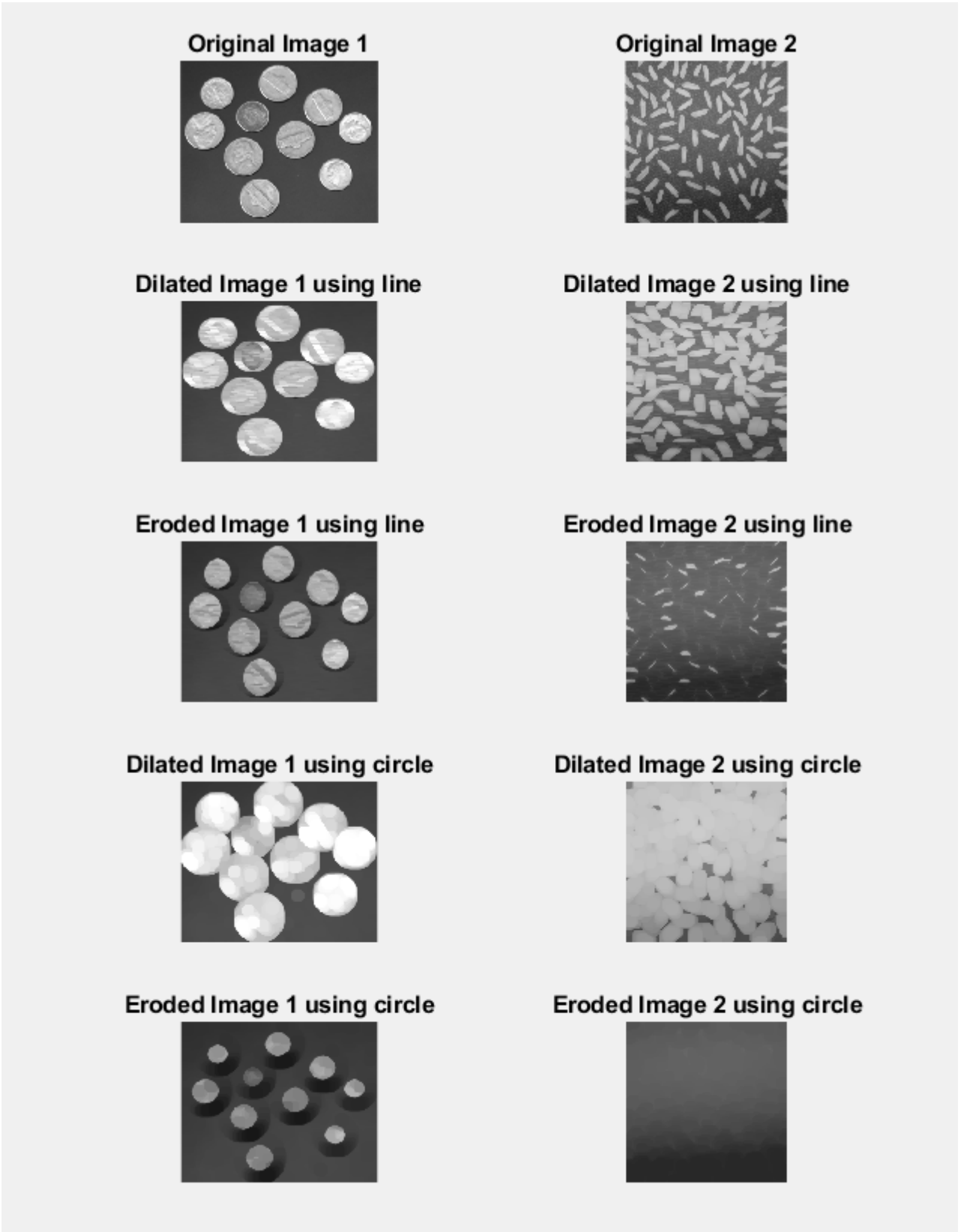
Code

e7a.m

```
clc;
close all;
clear all;
I = imread("coins.png");
I2 = imread("rice.png");
%% Original Images
subplot(5, 2, 1);
imshow(I);
title("Original Image 1");
subplot(5, 2, 2);
imshow(I2);
title("Original Image 2");


%% Line Dilate
se = strel("line", 10,0);
dilate = imdilate(I, se);
subplot(5, 2, 3);
imshow(dilate);
title("Dilated Image 1 using line");

dilate = imdilate(I2, se);
subplot(5, 2, 4);
imshow(dilate);
title("Dilated Image 2 using line");

%% Line Erode
erode = imerode(I, se);
subplot(5, 2, 5);
imshow(erode);
```

```
title("Eroded Image 1 using line");

erode = imerode(I2, se);
subplot(5, 2, 6);
imshow(erode);
title("Eroded Image 2 using line");

%% Circle Dilate
se_circle = strel('disk',10);
dilate = imdilate(I, se_circle);
subplot(5, 2, 7);
imshow(dilate);
title("Dilated Image 1 using circle");

dilate = imdilate(I2, se_circle);
subplot(5, 2, 8);
imshow(dilate);
title("Dilated Image 2 using circle");

%% Circle Erode
erode = imerode(I, se_circle);
subplot(5, 2, 9);
imshow(erode);
title("Eroded Image 1 using circle");

erode = imerode(I2, se_circle);
subplot(5, 2, 10);
imshow(erode);
title("Eroded Image 2 using circle");
```

Result


Original Image 1
Original Image 2
Dilated Image 1 using line
Dilated Image 2 using line
Eroded Image 1 using line
Eroded Image 2 using line
Dilated Image 1 using circle
Dilated Image 2 using circle
Eroded Image 1 using circle
Eroded Image 2 using circle

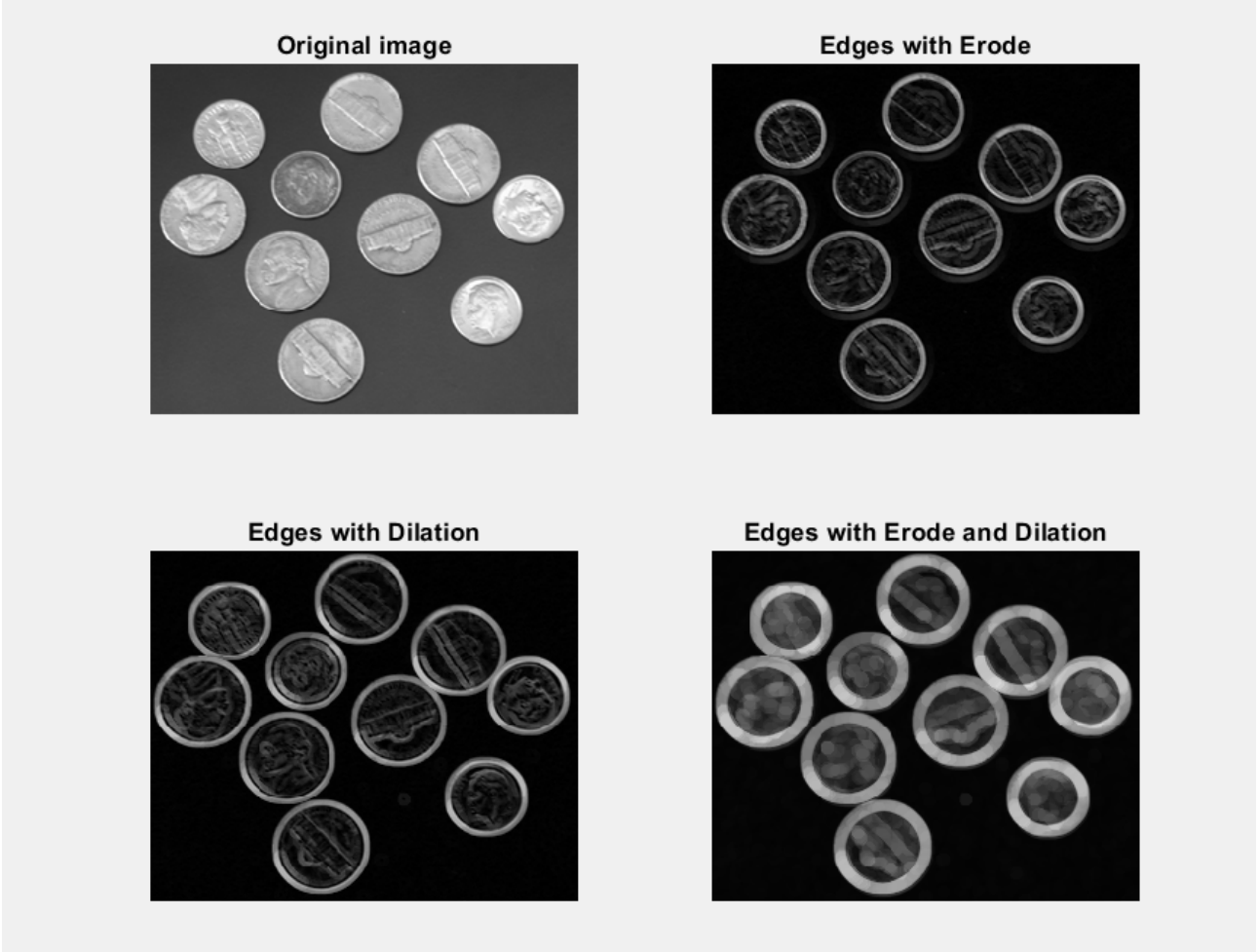
b. WAP to find edges in an image using morphological operators i.e. erosion only, dilation only and using both. Analyze the result.

Code

e7b.m

```
clc;
close all;
clear all;
I = imread("coins.png");
%% Original
subplot(2, 2, 1);
imshow(I);
title("Original image");
%% Edges Erode
se_circle = strel('disk',5);
erode = imerode(I, se_circle);
edge=I-erode;
subplot(2, 2, 2);
imshow(edge);
title("Edges with Erode");
%% Edges Dilate
dilate = imdilate(I, se_circle);
edge=dilate-I;
subplot(2, 2, 3);
imshow(edge);
title("Edges with Dilation");
%% Edges Both
edge=dilate-erode;
subplot(2, 2, 4);
imshow(edge);
title("Edges with Erode and Dilation");
```

Result



Analysis:

In Erosion only edge, the output image is obtained when Erode Image is subtracted from the Original Image resulting in providing the **Inner Boundary of the Image**. Similarly in case of Dilation only edge, the output image is obtained when Original Image is subtracted from the Dilated Image resulting in providing the **Outer Boundary of the Image.**

The Edges with both Erode and Dilation edges appear to be **summation of Erosion only edge and Dilation only edge**, forming a **Union** of both results.

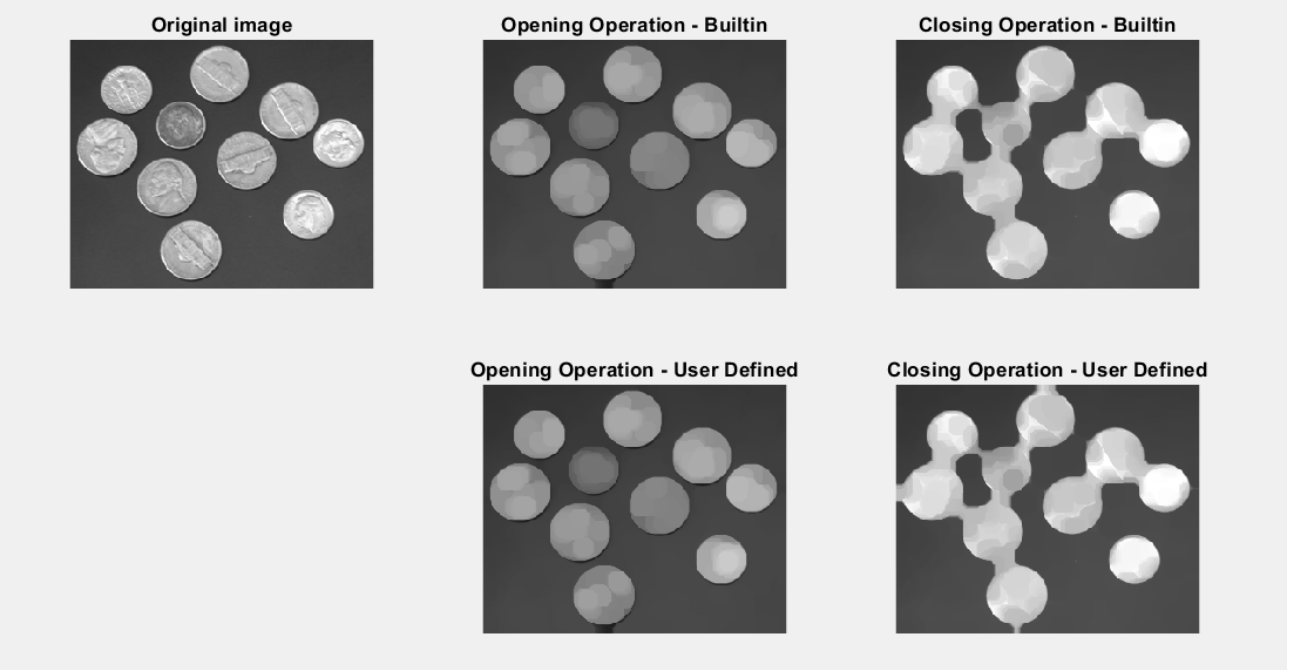
c. **WAP for opening and closing operation of an image using in-built functions imopen(), and imclose(). Also perform the same operations using dilation and erosion.**

Code

e7c.m

```
clc;
close all;
clear all;
I = imread("coins.png");
%% Original Image
subplot(2, 3, 1);
imshow(I);
title("Original image");

%% Opening and Closing Built-in Operation
se_circle = strel('disk',10);
open_operation=imopen(I,se_circle);
subplot(2, 3, 2);
imshow(open_operation);
title("Opening Operation - Builtin");

close_operation=imclose(I,se_circle);
subplot(2, 3, 3);
imshow(close_operation);
title("Closing Operation - Builtin");

%% Opening and Closing User-defined Operation
dilate = imdilate(I, se_circle);
erode = imerode(I, se_circle);
open_1=imdilate(erode, se_circle);
subplot(2, 3, 5);
imshow(open_1);
title("Opening Operation - User Defined");

close_1=imerode(dilate, se_circle);
subplot(2, 3, 6);
imshow(close_1);
title("Closing Operation - User Defined");
```

Result



d. Prove the duality theorem of erosion and dilation considering an image A and structuring element B.

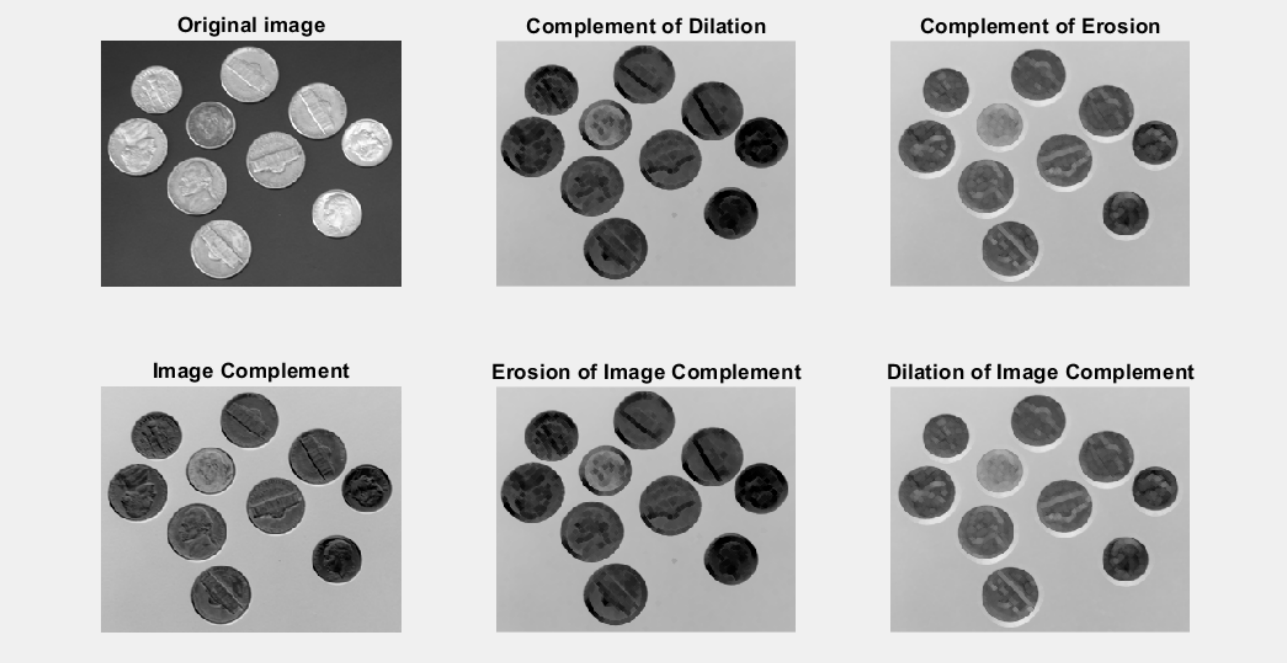
Code

e7d.m

```
clc;
close all;
clear all;
I = imread("coins.png");
I_comp=imcomplement(I);
%% Original Image
subplot(2, 3, 1);
imshow(I);
title("Original image");
subplot(2, 3, 4);
imshow(I_comp);
title("Image Complement");
%% Complement of Erosion and Dilation
se_circle = strel('disk',2);
dilate = imdilate(I, se_circle);
erode = imerode(I, se_circle);

comp_dilate=imcomplement(dilate);
subplot(2,3,2);
imshow(comp_dilate);
```

```
title("Complement of Dilation");

comp_erode=imcomplement(erode);
subplot(2,3,3);
imshow(comp_erode);
title("Complement of Erosion");

%% Erosion and Dilation of Image Complement
dilate_comp=imerode(I_comp, se_circle);
subplot(2,3,5);
imshow(dilate_comp);
title("Erosion of Image Complement");

erode_comp=imdilate(I_comp, se_circle);
subplot(2,3,6);
imshow(erode_comp);
title("Dilation of Image Complement");
```

Result



e. **Prove the duality theorem of opening and closing considering an image A and structuring element B.**

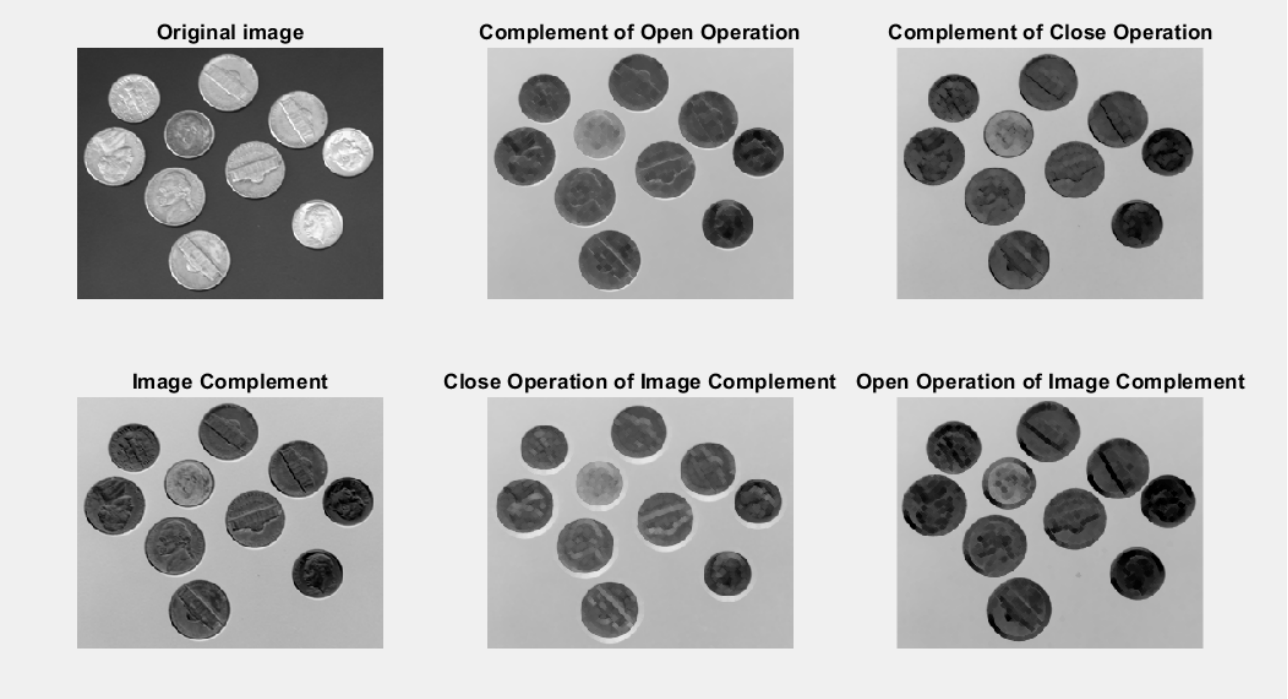
Code

e7e.m

```
clc;
close all;
clear all;
I = imread("coins.png");
I_comp=imcomplement(I);
%% Original Image
subplot(2, 3, 1);
imshow(I);
title("Original image");
subplot(2, 3, 4);
imshow(I_comp);
title("Image Complement");
%% Complement of Opening and Closing Op
se_circle = strel('disk',2);
open_op = imopen(I, se_circle);
close_op = imclose(I, se_circle);

comp_open_op=imcomplement(open_op);
subplot(2,3,2);
imshow(comp_open_op);
title("Complement of Open Operation");

comp_close_op=imcomplement(close_op);
subplot(2,3,3);
imshow(comp_close_op);
title("Complement of Close Operation");

%% Open and Close Operation of Image Complement
close_op_comp=imdilate(I_comp, se_circle);
subplot(2,3,5);
imshow(close_op_comp);
title("Close Operation of Image Complement");

open_op_comp=imerode(I_comp, se_circle);
subplot(2,3,6);
imshow(open_op_comp);
```

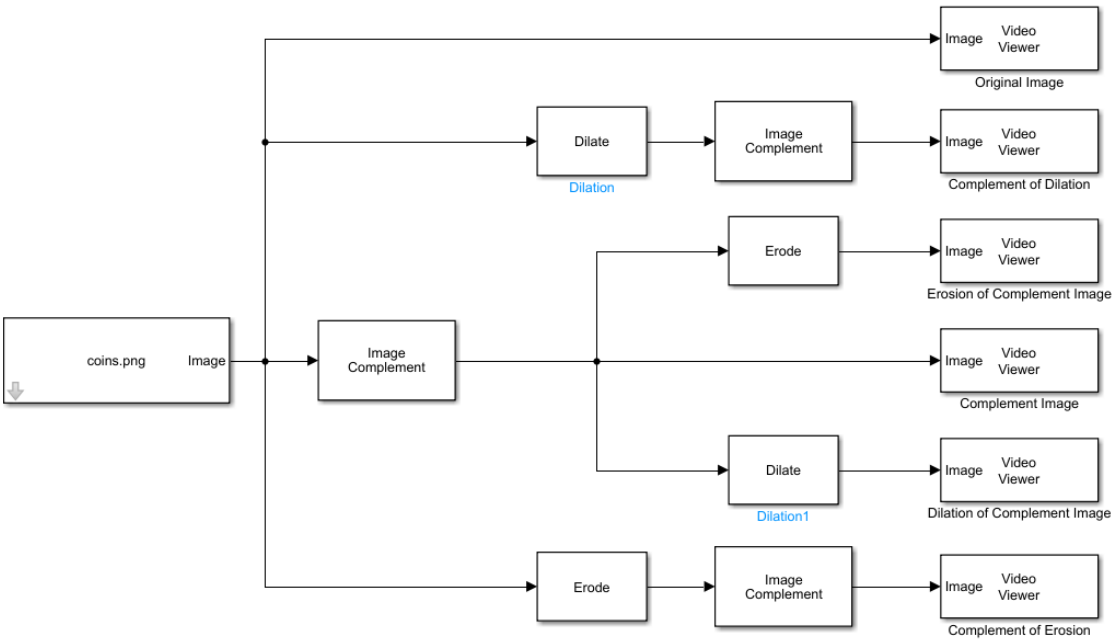
```
title("Open Operation of Image Complement");
```

Result

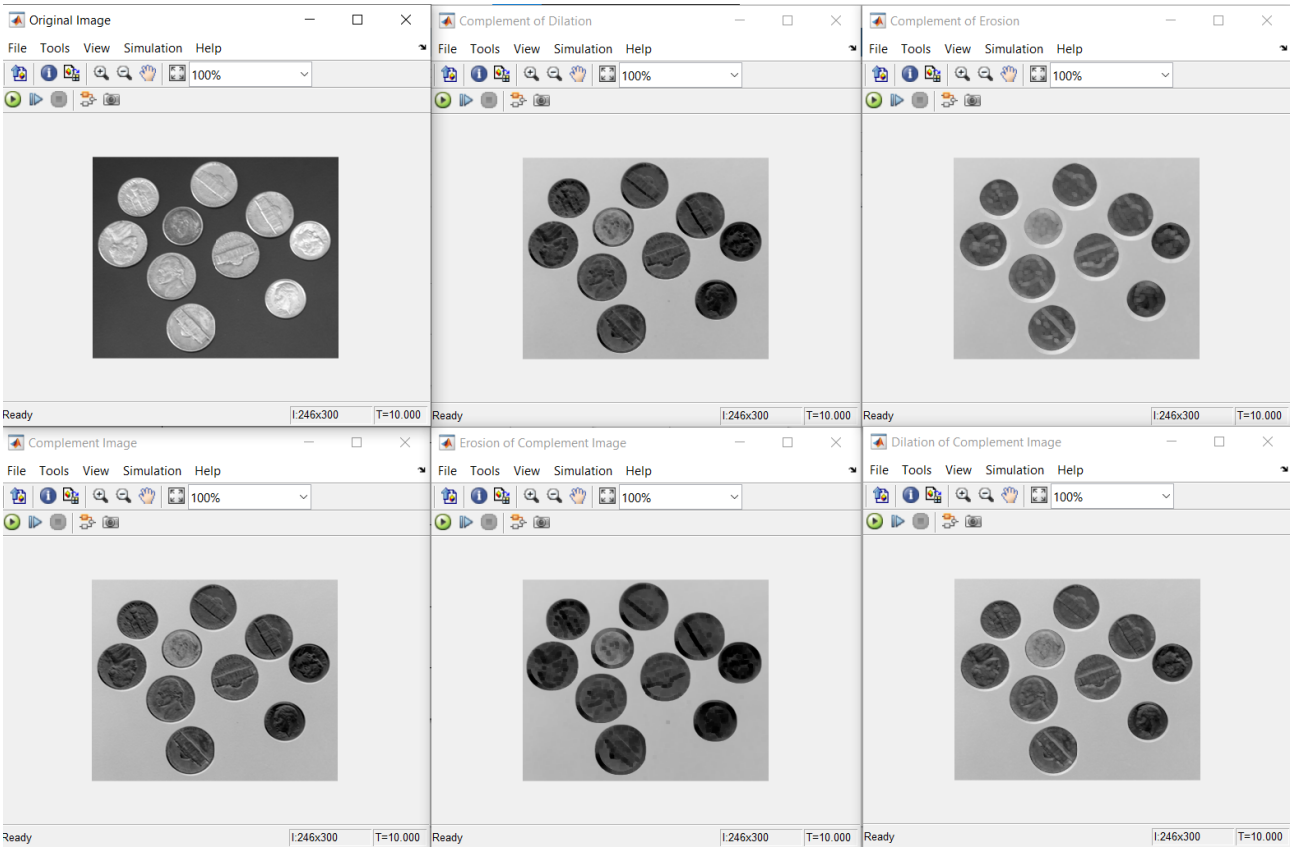


f. Prove the duality theorem of erosion and dilation considering an image A and structuring element B using Simulink

Simulink

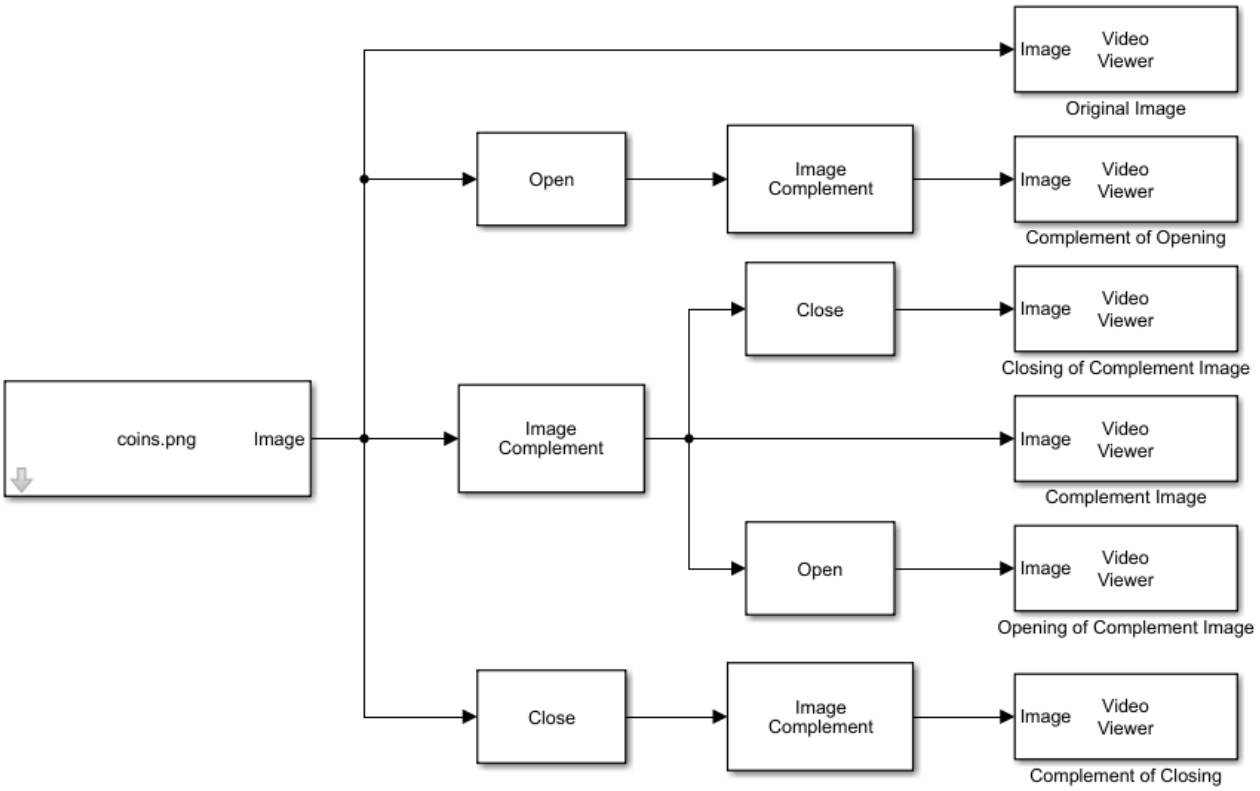


Result

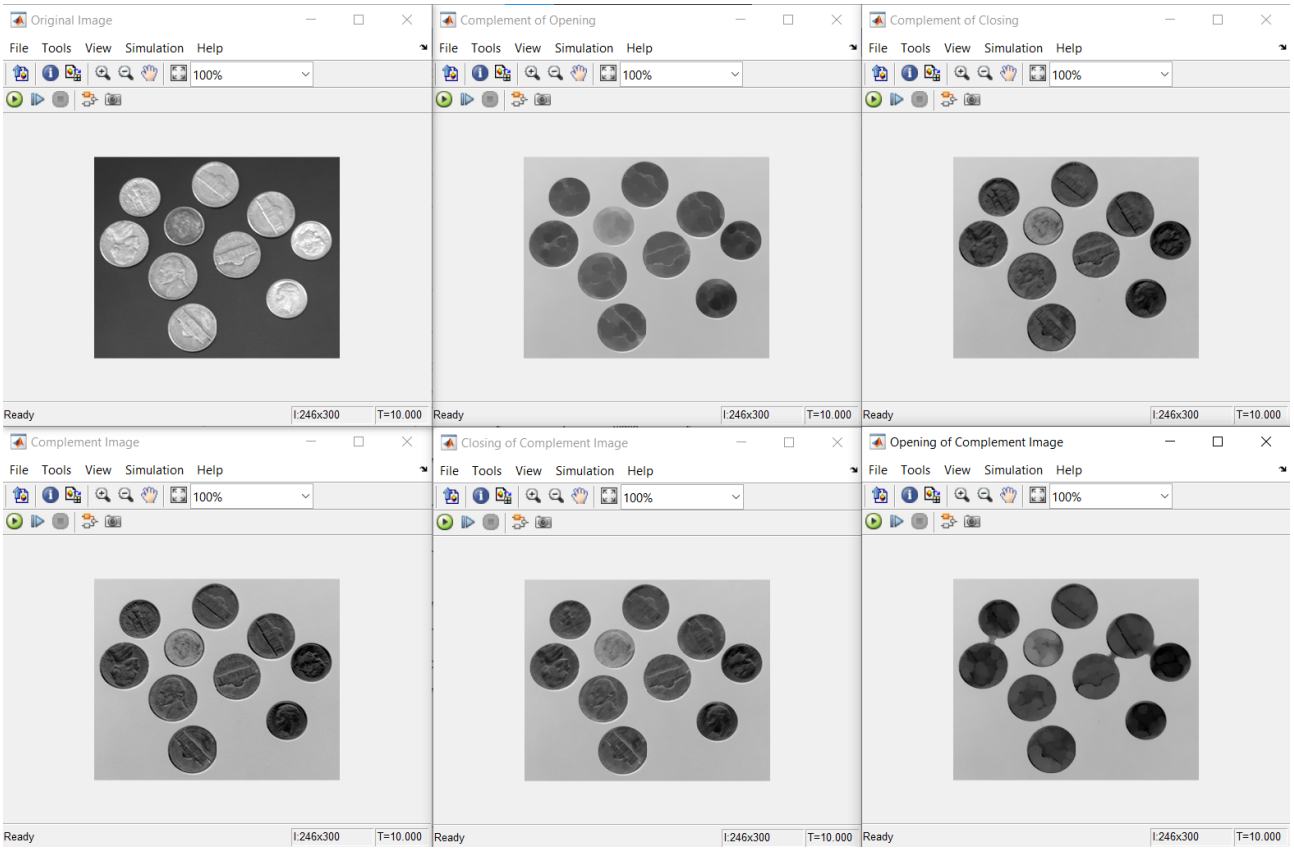


g. Prove the duality theorem of opening and closing considering an image A and structuring element B using Simulink

Simulink



Result



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