

School of Computer Science and Technology

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Course Name: Digital Image Processing

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Homework: 01

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Source Code:

byte[,] rotation(byte[,] f,float x0,float y0,float x1,float y1,int ow,int oh,float a){

```
int w = f.GetLength(0);
int h = f.GetLength(1);
double[,] T1 = new double[3,3];
T1[0,0] = 1; T1[1,0] = 0; T1[2,0] = 0;
T1[0,1] = 0; T1[1,1] = 1; T1[2,1] = 0;
T1[0,2] = -x0; T1[1,2] = -y0; T1[2,2] = 1;
double[,] R = new double[3,3];
R[0,0] = Cos(a); R[1,0] = Sin(a); R[2,0] = 0;
R[0,1] = -Sin(a); R[1,1] = Cos(a); R[2,1] = 0;
R[0,2] = 0; R[1,2] = 0; R[2,2] = 1;
double[,] T2 = new double[3,3];
T2[0,0] = 1; T2[1,0] = 0; T2[2,0] = 0;
T2[0,1] = 0; T2[1,1] = 1; T2[2,1] = 0;
T2[0,2] = x1; T2[1,2] = y1; T2[2,2] = 1;
double[,] Temp = multi(T2,R);
double[,] T = multi(Temp,T1);
double[,] T inv = new double[3,3];
T inv = invert(T);
byte[,] output = new byte[ow,oh];
for (int y=0; y<oh; y++)
  for(int x=0; x<ow; x++){
    double[,] temp = new double[3,1];
    temp[0,0] = x; temp[1,0] = y; temp[2,0] = 1;
    temp = multi(T inv,temp);
    double x pre = temp[0,0];
    double y pre = temp[1,0];
```

```
output[x,y] = bilInter(f,x pre,y pre);
 return output;
double[,] multi(double[,] f1,double[,] f2)
 int rows1 = f1.GetLength(0);
 int cols 1 = f1.GetLength(1);
 int cols2 = f2.GetLength(1);
 double[,] g = new double[rows1,cols2];
 for (int i = 0; i < rows1; i++)
   for (int j = 0; j < cols2; j++)
     for(int k = 0; k < cols 1; k++){
      g[i,j] += (double)(f1[i,k]*f2[k,j]);
  return g;
}
double[,] invert(double[,] f)
 int n = f.GetLength(0);
 double[,] augmentedMatrix = new double[n,2*n];
 for(int i = 0; i < n; i++){
  for(int j = 0; j < n; j++){
    augmentedMatrix[i,j] = f[i,j];
  augmentedMatrix[i, i + n] = 1;
  }
 /*for(int i = 0; i < n; i++){
   for(int j = n; j < 2*n; j++){
     if(i == j-n)
       augmentedMatrix[i,j] = 1;
```

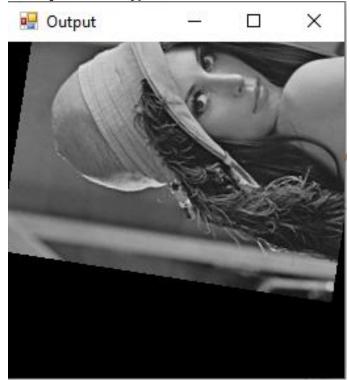
```
}else{
       augmentedMatrix[i,j] = 0;
  }*/
 for(int i = 0; i < n; i++){
   double pivot = augmentedMatrix[i,i];
   for(int j = 0; j < 2*n; j++){
    augmentedMatrix[i,j] /= pivot;}
   for(int j = 0; j < n; j++){
    if (j != i) {
       double factor = augmentedMatrix[j,i];
       for (int k = 0; k < 2 * n; k++) {
         augmentedMatrix[i,k]
                                                    factor
augmentedMatrix[i,k];}
 double[,] inverse = new double[n,n];
 for (int i = 0; i < n; i++) {
     for (int j = 0; j < n; j++) {
       inverse[i,j] = augmentedMatrix[i,j+n];
  return inverse;
byte bilInter(byte[,]f,double x,double y)
 int i = (int)x;
 int j = (int)y;
```

```
int w = f.GetLength(0);
 int h = f.GetLength(1);
 if(i < 0 || j < 0 || i >= w-1 || j >= h-1)
   return 0;
 double a = x-i;
 double b = y-j;
 double fxj = f[i,j]*(1-a)+f[i+1,j]*a;
 double fx_{j1} = f[i,j+1]*(1-a)+f[i+1,j+1]*a;
 double fxy = fxj*(1-b)+fxj1*b;
 return (byte)fxy;
void main(){
  byte[,] f = LoadImg();
  byte[,] output = rotation(f, 30,128,128,128,256,256,30);
  ShowImg("f",f);
  ShowImg("Output",output);
}
```

Input Image:



Output Image:



Using Different value:

