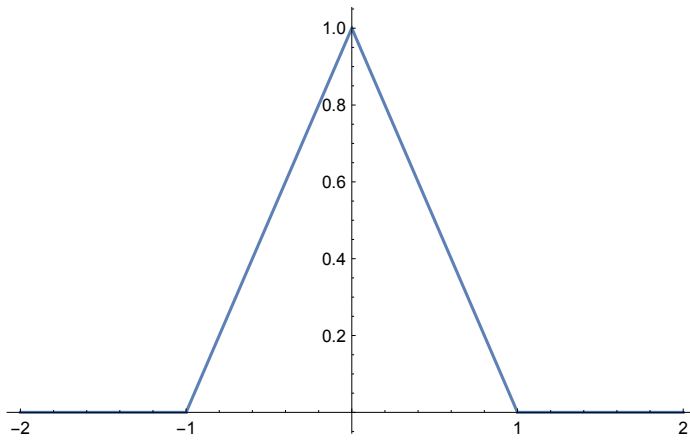# Approximation mit Pyramiden

In[1]:= `Hat[x_] := If[Abs[x] ≤ 1, 1 - Abs[x], 0]`
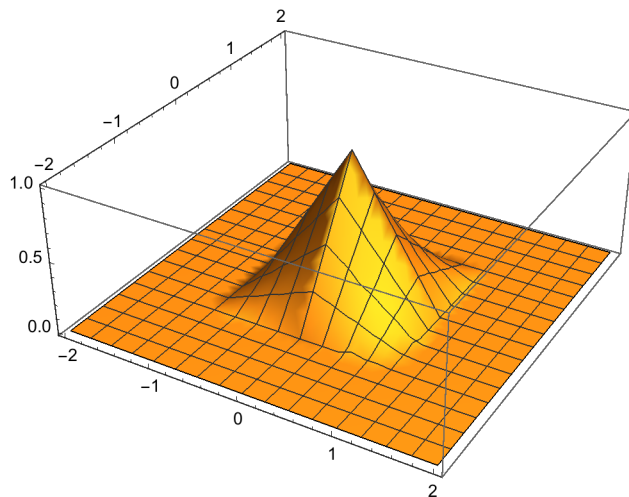
In[2]:= `Plot[Hat[x], {x, -2, 2}]`

Out[2]=

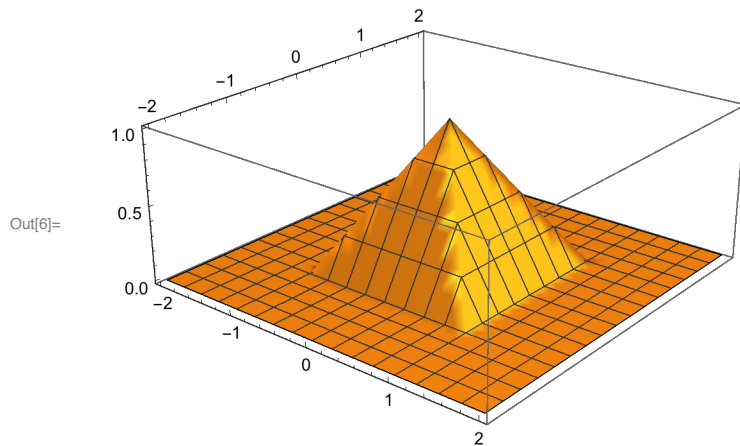In[3]:= `pyramid1[x_, y_] := Hat[x] * Hat[y]`

In[4]:= ```
pyramid2[x_, y_] := Piecewise[
    {{1 - x, 0 ≤ Abs[y] <= x ≤ 1},
     {1 - y, 0 ≤ Abs[x] ≤ y ≤ 1},
     {1 + x, 0 ≤ Abs[y] ≤ -x ≤ 1},
     {1 + y, 0 ≤ Abs[x] ≤ -y ≤ 1}}]
```

In[5]:= ```
p1 = Plot3D[pyramid1[x, y], {x, -2, 2}, {y, -2, 2}, PlotRange → All,
    Exclusions → None]
```
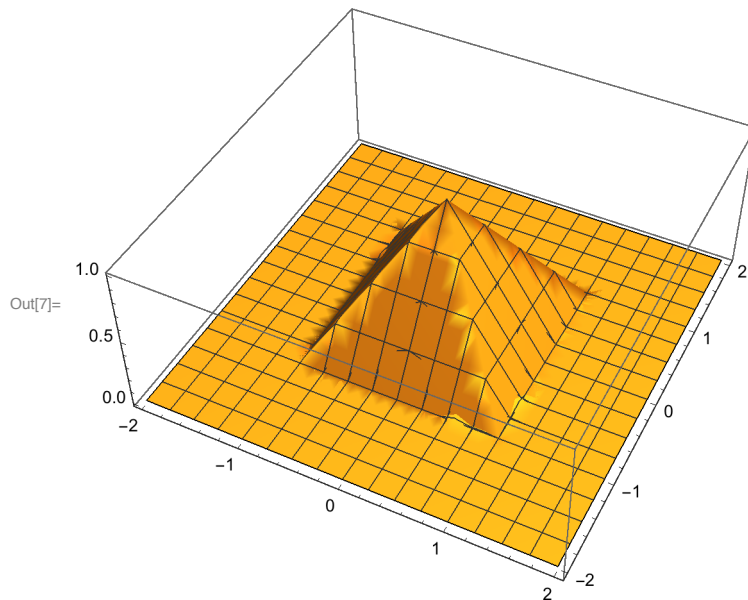
Out[5]=

In[6]:= `p2 = Plot3D[pyramid2[x, y] , {x, -2, 2}, {y, -2, 2}, PlotRange → All,`
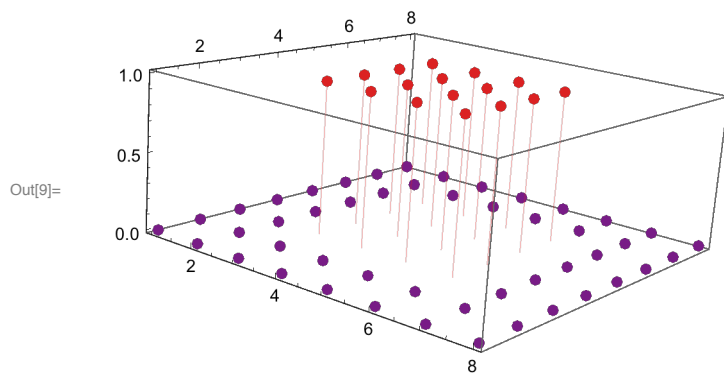`Exclusions → None]`

Out[6]=
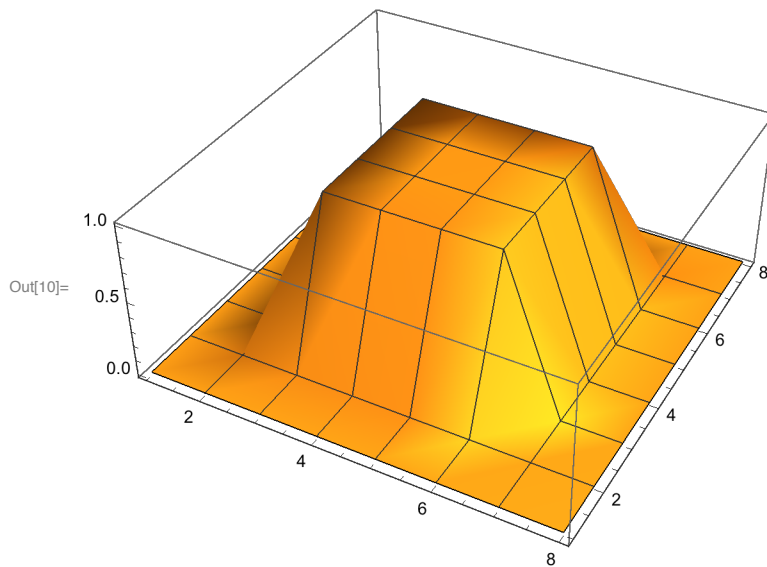

In[7]:= `Show[p1, p2]`

Out[7]=

In[8]:= `Ma = {{0, 0, 0, 0, 0, 0, 0, 0},`
`{0, 0, 0, 0, 0, 0, 0, 0},`
`{0, 0, 1, 1, 1, 1, 0, 0},`
`{0, 0, 1, 1, 1, 1, 0, 0},`
`{0, 0, 1, 1, 1, 1, 0, 0},`
`{0, 0, 1, 1, 1, 1, 0, 0},`
`{0, 0, 0, 0, 0, 0, 0, 0},`
`{0, 0, 0, 0, 0, 0, 0, 0}};`

In[9]:= `ListPointPlot3D[Table[{i, j, Ma[[i, j]]}, {i, 1, 8}, {j, 1, 8}], Filling → Bottom,`
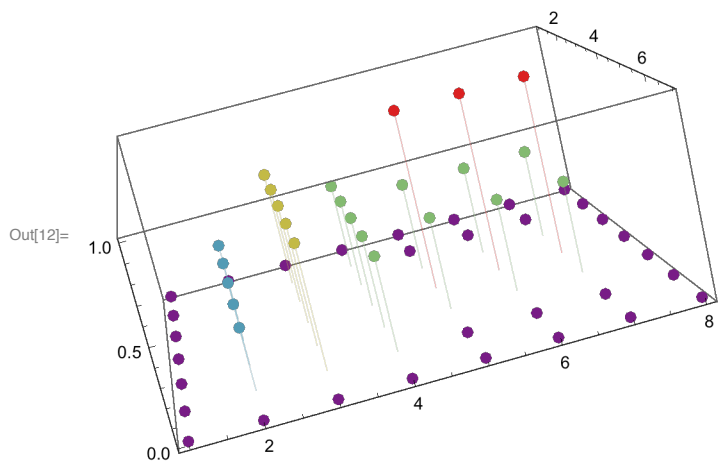`  PlotStyle → {PointSize[0.02]}, ColorFunction → "Rainbow"]`

Out[9]=

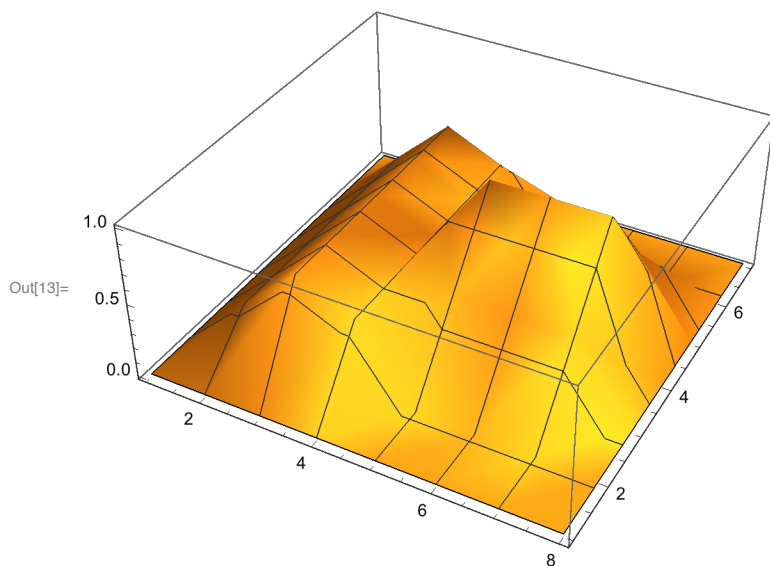In[10]:= `ListPlot3D[Ma, Mesh → 6]`

Out[10]=

In[11]:= `Mb = {{0, 0, 0, 0, 0, 0, 0, 0},`
`  {0, 1/3, 2/3, 1/2, 0, 0, 0, 0},`
`  {0, 1/3, 2/3, 1/2, 1/2, 1/2, 1/2, 0},`
`  {0, 1/3, 2/3, 1/2, 1, 1, 1, 0},`
`  {0, 1/3, 2/3, 1/2, 1/2, 1/2, 1/2, 0},`
`  {0, 1/3, 2/3, 1/2, 0, 0, 0, 0},`
`  {0, 0, 0, 0, 0, 0, 0, 0}};`

In[12]:= `ListPointPlot3D[Table[{i, j, Mb[[i, j]]}, {i, 1, 7}, {j, 1, 8}], Filling → Axis,`
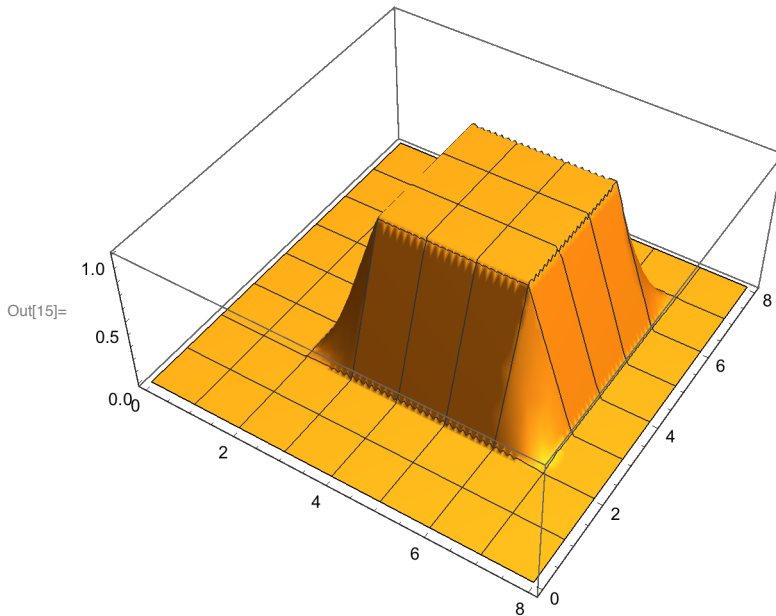`PlotStyle -> PointSize[0.02], ColorFunction → "Rainbow"`
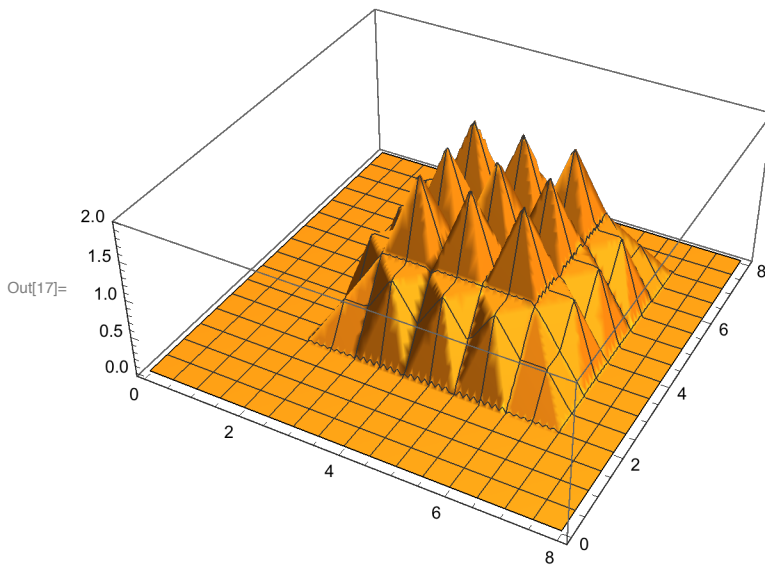`]`

Out[12]=

In[13]:= `ListPlot3D[Mb, Mesh → 6]`

Out[13]=

In[14]:= `PMa1[x_, y_] :=`
`Sum[Ma[[i, j]] * pyramid1[x - i, y - j],`
`{i, 1, 6}, {j, 1, 6}]`

In[15]:= `Plot3D[PMa1[x, y], {x, 0, 8}, {y, 0, 8}, PlotRange → All,`
`   Exclusions → None,`
`   PlotPoints → 30,`
`   Mesh → 7]`

Out[15]=

In[16]:= `PMa2[x_, y_] :=`
`   Sum[Ma[[i, j]] * pyramid2[x - i, y - j], {i, 1, 6}, {j, 1, 6}]`

In[17]:= `Plot3D[`
`   PMa2[x, y], {x, 0, 8}, {y, 0, 8},`
`   PlotRange → All,`
`   Exclusions → None,`
`   PlotPoints → 30]`

Out[17]=

In[18]:= `PMb1[x_, y_] :=`
`   Sum[Mb[[i, j]] * pyramid1[x - i, y - j],`
`    {i, 1, 6}, {j, 1, 6}]`

In[19]:=
```
Plot3D[
    PMb1[x, y], {x, 0, 8}, {y, 0, 8},
    PlotRange → All,
    Exclusions → None,
    PlotPoints → 30,
    Mesh → 7]
```
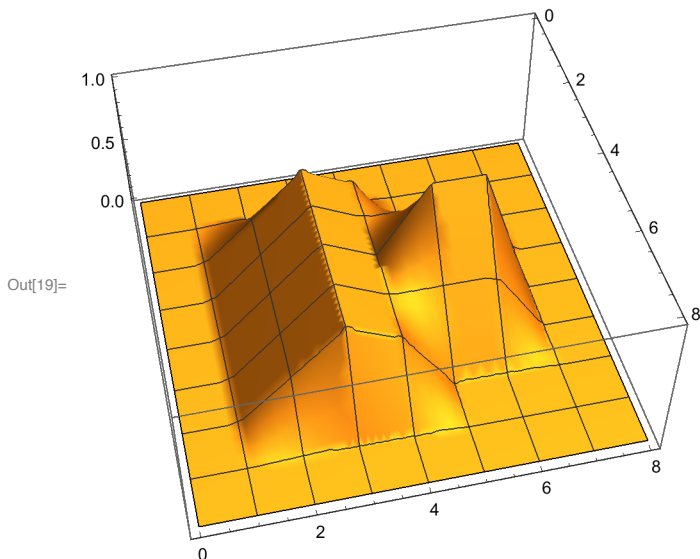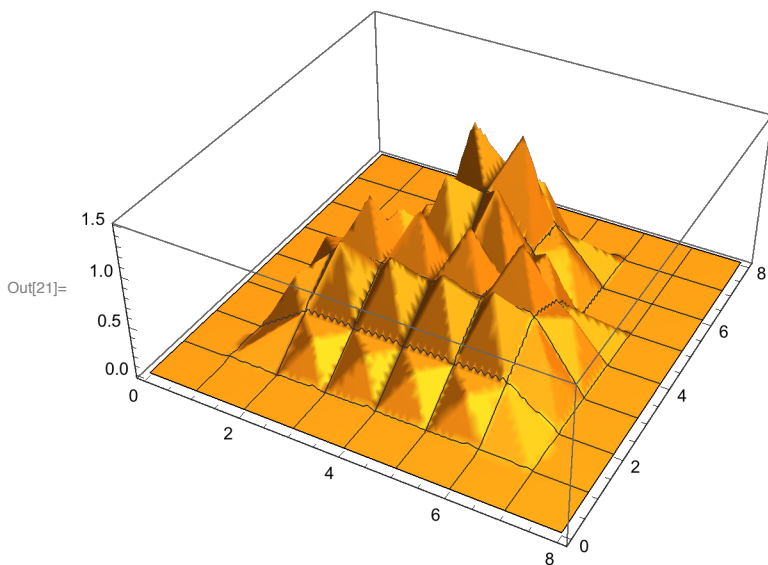
Out[19]=

In[20]:=
```
PMb2[x_, y_] :=
    Sum[Mb[[i, j]] * pyramid2[x - i, y - j],
      {i, 1, 6}, {j, 1, 6}]
```

In[21]:=
```
Plot3D[
    PMb2[x, y], {x, 0, 8}, {y, 0, 8},
    PlotRange → All,
    Exclusions → None,
    PlotPoints → 30,
    Mesh → 7]
```

Out[21]=

In[22]:= `img = Import["ExampleData/lena.tif"]`

Out[22]=

In[23]:= `imgsw = ColorConvert[img, "Grayscale"]`

Out[23]=

In[24]:= `lenadata = ImageData[imgsw, "Byte"][[41 ;; 104, 41 ;; 104]];`

In[25]:= `Image[lenadata, "Byte", ImageSize → Medium]`

Out[25]=

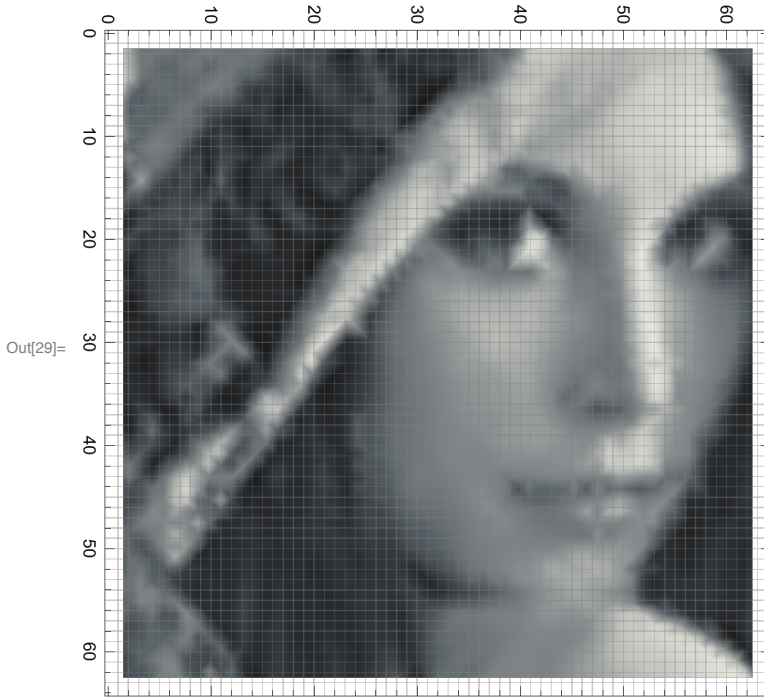In[26]:= `Dimensions[lenadata]`
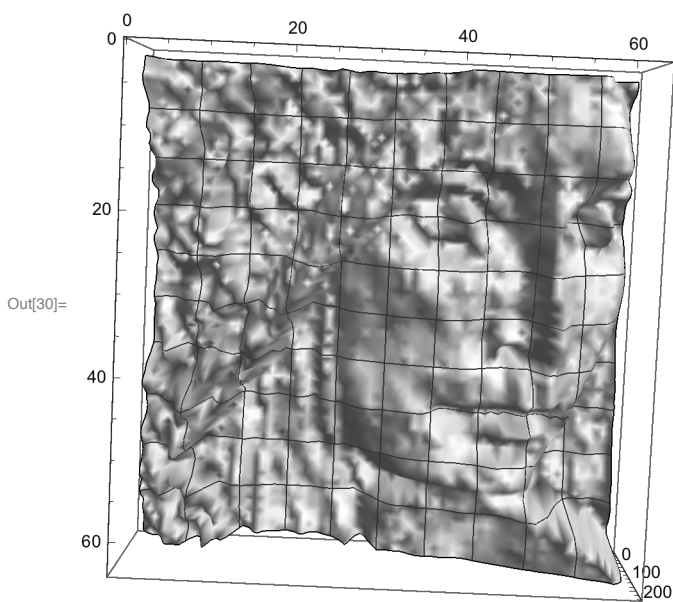
Out[26]= {64, 64}

In[27]:=
```
Do[
   lenap1[s, t, x_, y_] =
    Sum[
      lenadata[[s + i, t + j]] * pyramid1[x - (s + i), y - (t + j)],
      {i, -1, 1}, {j, -1, 1}]
   , {s, 2, 62}, {t, 2, 62}
  ];
```

In[28]:= `lenafn1[x_, y_] :=`
`  lenap1[Round[x], Round[y], x, y]`

In[29]:= `Rotate[`
`  DensityPlot[lenafn1[x, y], {x, 1, 63}, {y, 1, 63},`
`   ColorFunction → ColorData["GrayTones"],`
`   GridLines → {Range[1, 63], Range[1, 63]}, Exclusions → None], -Pi/2]`

Out[29]=

In[30]:= `Plot3D[lenafn1[x, y], {x, 1, 63}, {y, 1, 63}, PlotPoints → 20,`
`  ColorFunction →`
`   Function[{x, y, z}, CMYKColor[z]],`
`  PlotStyle → GrayLevel[.75], Mesh → 9, Exclusions → None]`

Out[30]=
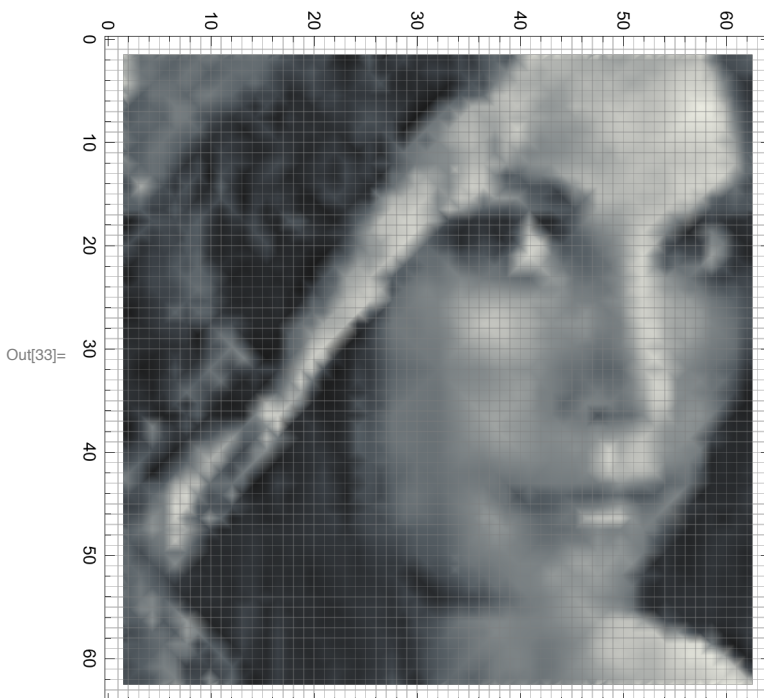
```
In[31]:= Do[
         lenap2[s, t, x_, y_] =
          0.75 * lenadata[[s, t]] + 0.25 *
            Sum[
             lenadata[[s + i, t + j]] * pyramid2[x - (s + i), y - (t + j)],
             {i, -1, 1}, {j, -1, 1}]
          , {s, 2, 62}, {t, 2, 62}
         ];

In[32]:= lenafn2[x_, y_] :=
         lenap2[Round[x], Round[y], x, y]

In[33]:= Rotate[
         DensityPlot[lenafn2[x, y], {x, 1, 63}, {y, 1, 63},
          ColorFunction → ColorData["GrayTones"],
          GridLines → {Range[1, 63], Range[1, 63]}, Exclusions → None], -Pi / 2]
```

Out[33]=

In[34]:= `Plot3D[lenafn2[x, y], {x, 1, 63}, {y, 1, 63}, PlotPoints → 25,`
  `ColorFunction →`
   `Function[{x, y, z}, CMYKColor[z]],`
  `PlotStyle → GrayLevel[.75], Mesh → 63, Exclusions → None]`

Out[34]=