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In[1]:= SetOptions[EvaluationNotebook[], Background → White]

img = ;

img2 = ColorSeparate[img][[1]]  
ImageDimensions@img2



{1418, 1048}

```
skeleton = SkeletonTransform[img2, .09]
```



```
skeleton2 = Binarize@ImageResize[skeleton, {30 * 60, Length@notes}]
```



# Scan and Sonify

```

min = Min@ImageData[skeleton2]
max = Max@ImageData[skeleton2]
img3 = Rescale[(ImageData[skeleton2]), {min, max}];
dt = 0.2; (*duration of each vertical scan line*)
damp = 2; (* max duration of a note*)
scannotes = Table[
  (*test img3={{0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0},
    {0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0}};*)
  scan = Join[{0}, img3[[i]], {0}];
  (*join the notes into longer intervals to avoid unnecessary gated-ness*)
  intr = Flatten@Table[If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] != 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] != 0 && scan[[j + 1]] == 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0),
    If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0), {j, j}, j],
    Nothing], {j, 2, Length@scan}] - 1;

  (*Sound the notes with proper duration*)
  Table[SoundNote[assoc[i], If[Norm[{intr[[j]], intr[[j + 1]] + 1} * dt] < damp,
    {intr[[j]], intr[[j + 1]] + 1} * dt, {intr[[j]] * dt, intr[[j]] * dt + damp}],
    "Piano"], {j, 1, Length@intr - 1}],
  {i, 8, (Dimensions@img3)[[1]] - 8}];

```

0

1

Sound@Flatten@scannotes



# Shorter

```

min = Min@ImageData[skeleton2]
max = Max@ImageData[skeleton2]
img3 = Rescale[(ImageData[skeleton2]), {min, max}];
dt = 0.2/2; (*duration of each vertical scan line*)
damp = 2/2; (* max duration of a note*)
strum = 0.1/1.7;
scannotes = Table[
  (*test img3={{0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0},
   {0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0}};*)
  scan = Join[{0}, img3[[i]], {0}];
  (*join the notes into longer intervals to avoid unnecessary gated-ness*)
  intr = Flatten@Table[If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] != 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] != 0 && scan[[j + 1]] == 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0),
    If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0), {j, j}, j],
    Nothing], {j, 2, Length@scan}] - 1;

  (*Sound the notes with proper duration*)
  Table[SoundNote[assoc[i], If[Norm[{intr[[j]], intr[[j + 1]] + 1} * dt] < damp,
    {intr[[j]], intr[[j + 1]] + 1} * dt + strum * i, {intr[[j]] * dt,
    intr[[j]] * dt + damp + strum * i}], "Piano"], {j, 1, Length@intr - 1}],
  {i, 8, (Dimensions@img3)[[1]] - 8}];
0
1

```

Sound@Flatten@scannotes



```

Export[FileNameJoin[{NotebookDirectory[], "rotifer_strum_short.mid"}],
Sound@Flatten@scannotes]

/Users/darashayda1xfer/Documents/Sufi Notes/rotifer/rotifer_strum_short.mid

```

# Midi Export

```

Export[FileNameJoin[{NotebookDirectory[], "rotifer.mid"}],
Sound@Flatten@scannotes]

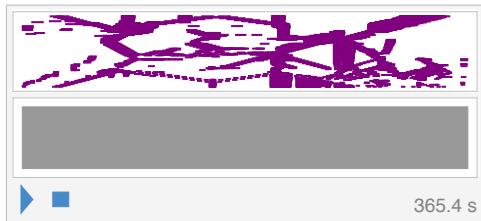
min = Min@ImageData[skeleton2]
max = Max@ImageData[skeleton2]
img3 = Rescale[(ImageData[skeleton2]), {min, max}];
dt = 0.2; (*duration of each vertical scan line*)
damp = 2; (* max duration of a note*)
strum = 0.1;
scannotes = Table[
(*test img3={{0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0},
{0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0}};*)
scan = Join[{0}, img3[[i]], {0}];
(*join the notes into longer intervals to avoid unnecessary gated-ness*)
intr = Flatten@Table[If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] != 0) ||
  (scan[[j]] != 0 && scan[[j - 1]] != 0 && scan[[j + 1]] == 0) ||
  (scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0),
  If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0), {j, j}, j],
  Nothing], {j, 2, Length@scan}] - 1;

(*Sound the notes with proper duration*)
Table[SoundNote[assoc[i], If[Norm[{intr[[j]], intr[[j + 1]] + 1} * dt] < damp,
{intr[[j]], intr[[j + 1]] + 1} * dt + strum * i, {intr[[j]] * dt,
intr[[j]] * dt + damp + strum * i}], "Piano"], {j, 1, Length@intr - 1}],
{i, 8, (Dimensions@img3)[[1]] - 8}];

0
1

```

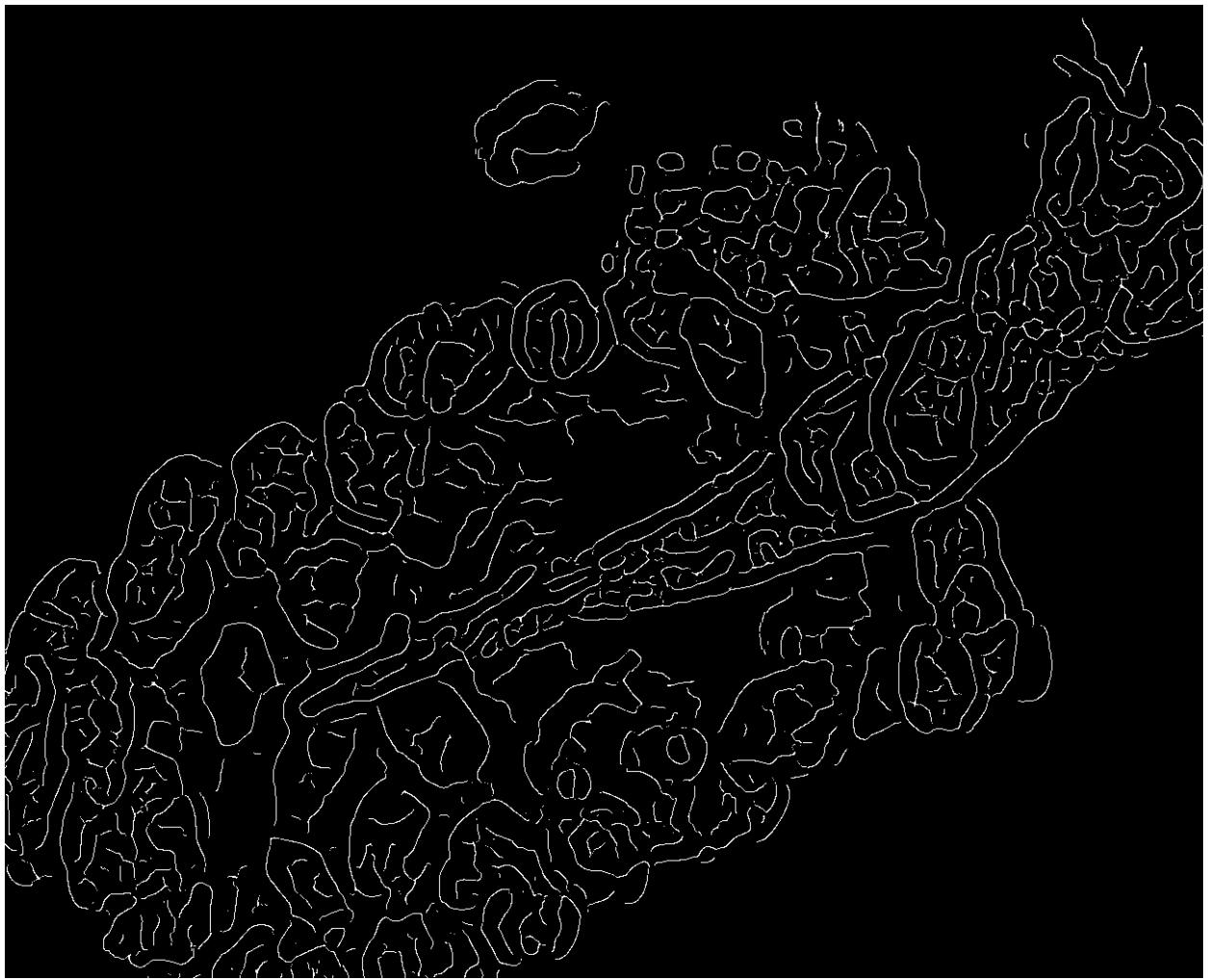
Sound@Flatten@scannotes



```
Export[FileNameJoin[{NotebookDirectory[], "rotifer_strum.mid"}],  
Sound@Flatten@scannotes]
```

```
/Users/darashaydalxfer/Documents/Sufi Notes/rotifer/rotifer_strum.mid
```

```
edge = EdgeDetect[img, 15]
```



```
edge2 = Binarize@ImageResize[edge, {30 * 60, Length@notes}]
```



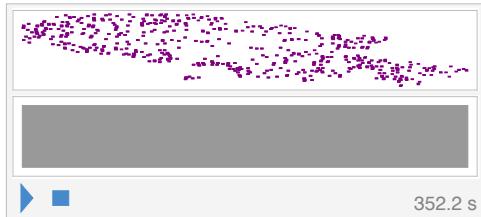
```
min = Min@ImageData[edge2]
max = Max@ImageData[edge2]
img3 = Rescale[(ImageData[edge2]), {min, max}];
dt = 0.2; (*duration of each vertical scan line*)
damp = 2; (* max duration of a note*)
scannotes = Table[
  (*test img3={{0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0},
    {0,1,1,1,0,1,0,1,1,0,0,0,0,1,0,1,1,1,0,0}};*)
  scan = Join[{0}, img3[[i]], {0}];
  (*join the notes into longer intervals to avoid unnecessary gated-ness*)
  intr = Flatten@Table[If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] != 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] != 0 && scan[[j + 1]] == 0) ||
    (scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0),
    If[(scan[[j]] != 0 && scan[[j - 1]] == 0 && scan[[j + 1]] == 0), {j, j}, j],
    Nothing], {j, 2, Length@scan}] - 1;

  (*Sound the notes with proper duration*)
  Table[SoundNote[assoc[i], If[Norm[{intr[[j]], intr[[j + 1]] + 1} * dt] < damp,
    {intr[[j]], intr[[j + 1]] + 1} * dt, {intr[[j]] * dt, intr[[j]] * dt + damp}],
    "Piano"], {j, 1, Length@intr - 1}],
  {i, 1, (Dimensions@img3)[[1]]}];
```

0

1

Sound@Flatten@scannotes



```
Export[FileNameJoin[{NotebookDirectory[], "rotifer_edge.mid"}],
 Sound@Flatten@scannotes]

/Users/darashayda1xfer/Documents/Sufi Notes/rotifer/rotifer_edge.mid
```

# Piano 88 Keyboard

Frequency (Hz)   Scientific Note #

27.500	A0	A0♯	29.135
30.868	B0		
32.703	C1	C1♯	34.648
36.708	D1	D1♯	38.891
41.203	E1		
43.654	F1	F1♯	46.249
48.999	G1	G1♯	51.913
55.000	A1	A1♯	58.271
61.735	B1		
65.406	C2	C2♯	69.296
73.416	D2	D2♯	77.782
82.407	E2		
87.307	F2	F2♯	92.499
97.999	G2	G2♯	103.83
110.00	A2	A2♯	116.54
123.47	B2		
130.81	C3	C3♯	138.59
146.83	D3	D3♯	155.56
164.81	E3		
174.61	F3	F3♯	185.00
196.00	G3	G3♯	207.65
220.00	A3	A3♯	233.08
246.94	B3		
<b>261.63</b>	<b>C4</b>	<b>C4♯</b>	<b>277.18</b>
293.67	D4	D4♯	311.13
329.63	E4		
349.23	F4	F4♯	369.99
392.00	G4	G4♯	415.30
<b>440.00</b>	<b>A4</b>	<b>A4♯</b>	<b>466.16</b>
493.88	B4		
523.25	C5	C5♯	554.37
587.33	D5	D5♯	622.25
659.26	E5		
698.46	F5	F5♯	739.99
783.99	G5	G5♯	830.61
880.00	A5	A5♯	932.33
987.77	B5		
1046.50	C6	C6♯	1108.73
1174.66	D6	D6♯	1244.51
1318.51	E6		
1396.91	F6	F6♯	1479.98
1567.98	G6	G6♯	1661.22
1760.00	A6	A6♯	1864.66
1975.53	B6		
2093.00	C7	C7♯	2217.46
2349.32	D7	D7♯	2489.02
2637.02	E7		
2793.83	F7	F7♯	2959.96
3135.96	G7	G7♯	3322.44
3520.00	A7	A7♯	3729.31
3951.07	B7		
4186.01	C8		

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Here is a list consisting of the frequencies in a one-octave, equal-tempered chromatic scale starting at 440 Hertz.

```
freq = Table[N[440 * 2i/12], {i, -4 * 12, 3 * 12 + 3}]
{27.5, 29.1352, 30.8677, 32.7032, 34.6478, 36.7081, 38.8909, 41.2034, 43.6535,
 46.2493, 48.9994, 51.9131, 55., 58.2705, 61.7354, 65.4064, 69.2957, 73.4162,
 77.7817, 82.4069, 87.3071, 92.4986, 97.9989, 103.826, 110., 116.541, 123.471,
 130.813, 138.591, 146.832, 155.563, 164.814, 174.614, 184.997, 195.998,
 207.652, 220., 233.082, 246.942, 261.626, 277.183, 293.665, 311.127, 329.628,
 349.228, 369.994, 391.995, 415.305, 440., 466.164, 493.883, 523.251, 554.365,
 587.33, 622.254, 659.255, 698.456, 739.989, 783.991, 830.609, 880., 932.328,
 987.767, 1046.5, 1108.73, 1174.66, 1244.51, 1318.51, 1396.91, 1479.98,
 1567.98, 1661.22, 1760., 1864.66, 1975.53, 2093., 2217.46, 2349.32, 2489.02,
 2637.02, 2793.83, 2959.96, 3135.96, 3322.44, 3520., 3729.31, 3951.07, 4186.01}
```

Corresponding list of notes:

```
notes = Join[{"A" <> ToString[0], "A#" <> ToString[0], "B" <> ToString[0]},
  Flatten@Table[{"C" <> ToString[i], "C#" <> ToString[i], "D" <> ToString[i],
    "D#" <> ToString[i], "E" <> ToString[i], "F" <> ToString[i], "F#" <> ToString[i],
    "G" <> ToString[i], "G#" <> ToString[i], "A" <> ToString[i],
    "A#" <> ToString[i], "B" <> ToString[i]}, {i, 1, 7}], {"C" <> ToString[8]}]
{A0, A#0, B0, C1, C#1, D1, D#1, E1, F1, F#1, G1, G#1, A1, A#1, B1, C2, C#2,
  D2, D#2, E2, F2, F#2, G2, G#2, A2, A#2, B2, C3, C#3, D3, D#3, E3, F3, F#3,
  G3, G#3, A3, A#3, B3, C4, C#4, D4, D#4, E4, F4, F#4, G4, G#4, A4, A#4, B4, C5,
  C#5, D5, D#5, E5, F5, F#5, G5, G#5, A5, A#5, B5, C6, C#6, D6, D#6, E6, F6, F#6,
  G6, G#6, A6, A#6, B6, C7, C#7, D7, D#7, E7, F7, F#7, G7, G#7, A7, A#7, B7, C8}

Length@notes
Length@freq
88
88
```

Associate the notes the frequencies and key number:

```
assoc = <|
  0 → 0,
  Sequence @@ Flatten@Table[{freq[[i]] → notes[[i]],
    notes[[i]] → freq[[i]]}, i → notes[[i]]], {i, 1, Length@notes}]>;
```