Computational Vision
U. Minn. Psy 5036
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Lecture 5

Signal-in-noise psychophysics demo

■ Initialize

```
In[45]:=
         Off[General::spell1]

In[46]:= z[p_] := Sqrt[2] InverseErf[1 - 2 p]; dprime[x_]

In[47]:= ndist = NormalDistribution[0, 1];
         size = 64; (* image size *)
         i = 0; pc = 0;
         numtrials = 10;
```

■ Define test images

■ Basis set: Cartesian representation of Gabor functions

In[52]:=
```
cgabor[x_,y_, fx_, fy_,s_] :=
Exp[-(x^2 +  y^2)/s^2] Cos[2 Pi(fx x + fy y)]
sgabor[x_,y_, fx_, fy_, s_] :=
Exp[-(x^2 +  y^2)/s^2] Sin[2 Pi(fx x + fy y)]
```

■ Various frequencies , vertical orientations, and fixed

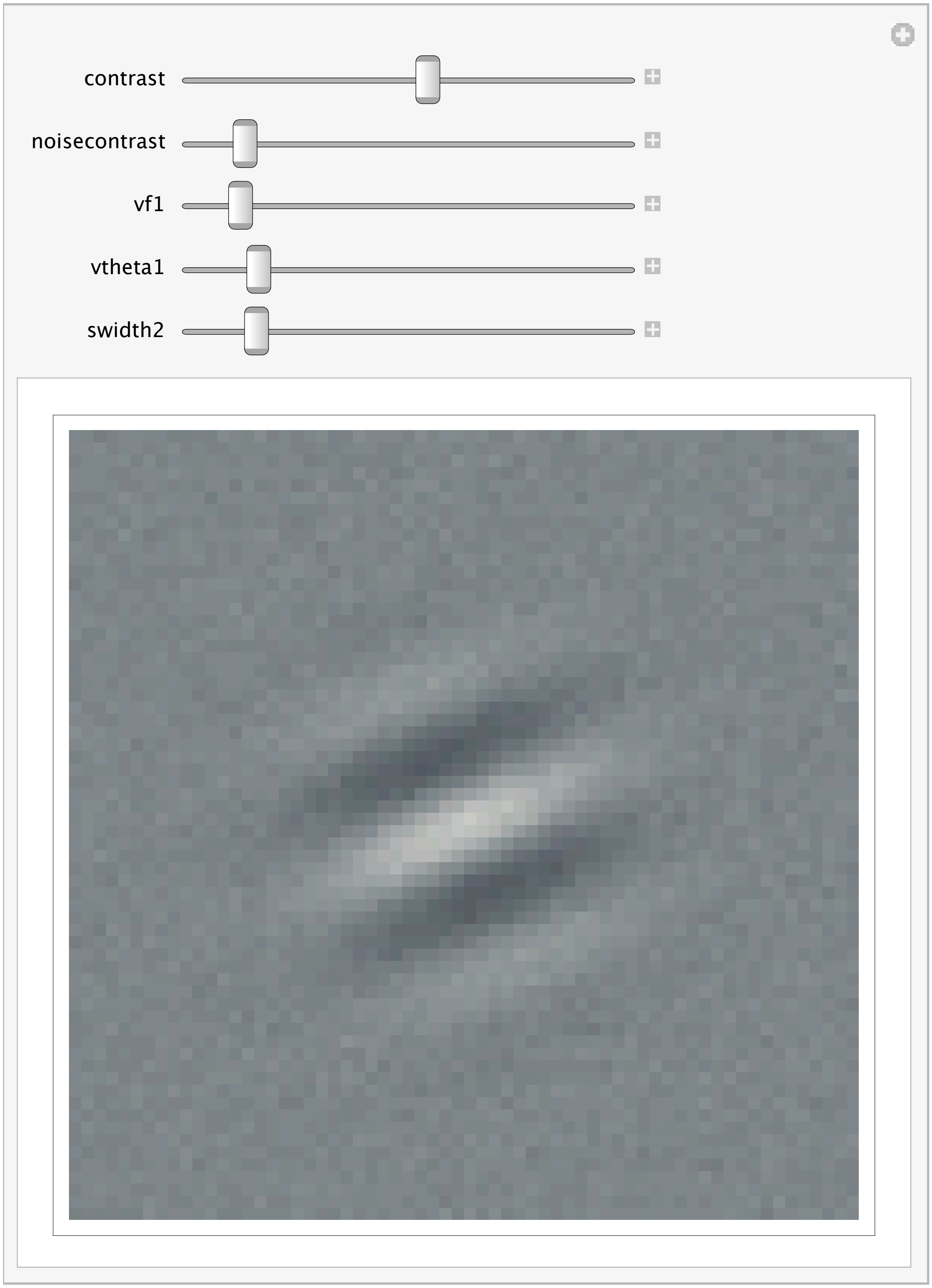
In[54]:=
```
vtheta = Table[i1 Pi/4, {i1,4}]
vf = {1,1,2,4};
swidth = {.25,1,4};
```

Out[54]= $\left\{\frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi\right\}$

```
signal =
  Table[N[cgabor[x, y, vf⟦1⟧ Cos[vtheta⟦1⟧], vf
   {x, -2, 2, 4/(size - 1)}, {y, -2, 2, 4/(size - 1)}];
Print[Max[signal], "   ", Min[signal], "   ", Dim
noise := Table[RandomReal[ndist], {size}, {siz
```

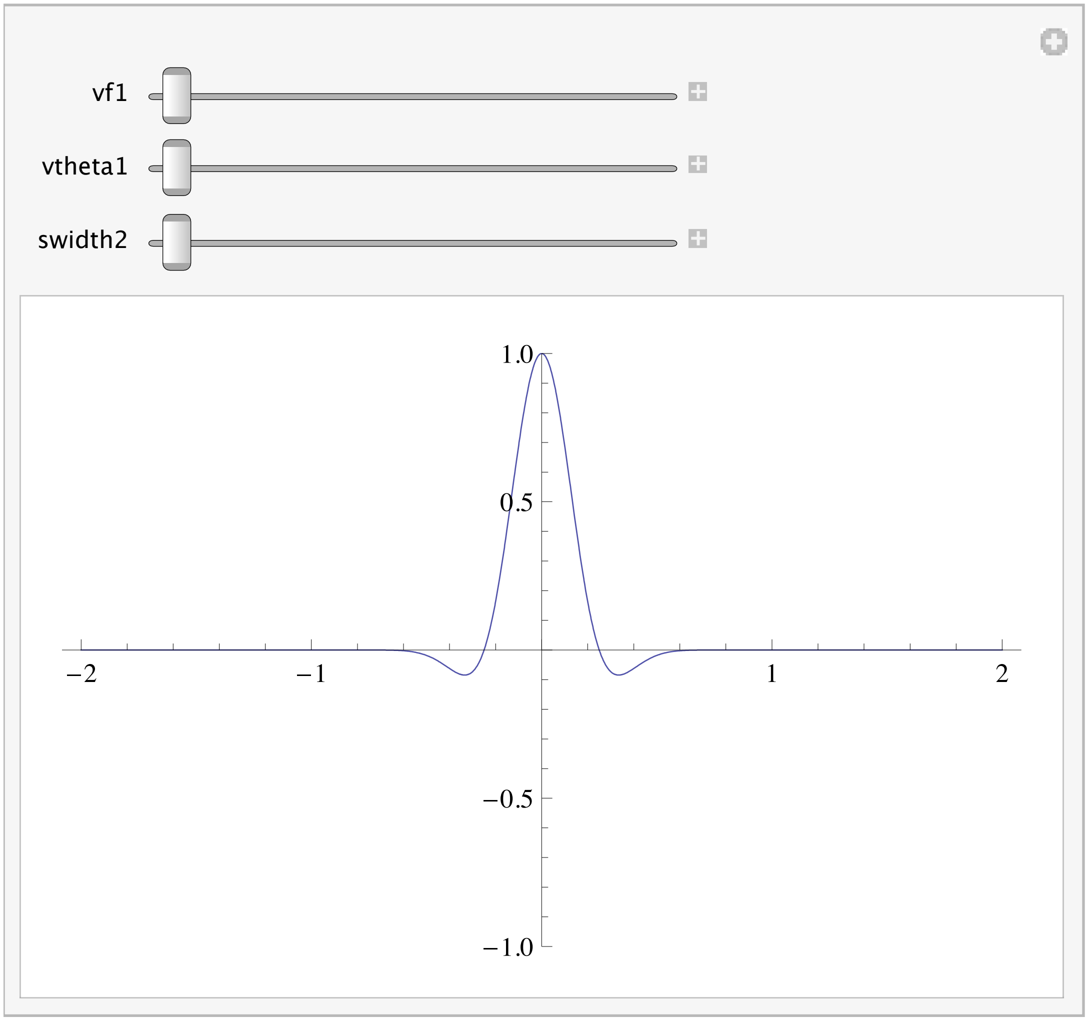
```
In[72]:= Manipulate[
          signal2 =
           Table[contrast * N[cgabor[x, y, vf1 Cos[vtheta
                            4                          4
            {x, -2, 2, ────────}, {y, -2, 2, ────────}];
                        size - 1                   size - 1
          noises = noisecontrast * noise;

          ArrayPlot[signal2 + noises, Mesh → False, PlotR
           ColorFunction → "GrayTones"], {{contrast, .5}
          {vf1, 1, 4}, {vtheta1, 0, Pi}, {swidth2, .25, 4
```

Out[72]=



```
In[61]:= Manipulate[Plot[cgabor[x, 0, vf1 Cos[vtheta1],
           {x, -2, 2}, Frame → False, PlotRange → {-1, 1}]
          {swidth2, .25, 4}]
```

Out[61]=



```
In[73]:= blank = Table[0.0, {x, -2, 2, 4 / (size - 1)}, {y,
         gblank = ArrayPlot[blank, Mesh → False, Frame →
            ColorFunction → "GrayTones" ];
         flash = blank;
```

```
In[76]:= data = {{"Was I Correct?", "Was Ideal Correct?'
         numtrials = 10;

         scon = 0.01;
         ncon = .15;
```

■ Put up stimulus window

```
In[80]:= CreateDocument[Dynamic[flash], ShowCellBracket
           WindowMargins → {{Automatic, 0}, {Automatic,
           Background → Black, NotebookFileName → "2AFC
```

- **Define a trial**

```
In[81]:= twoflashes :=
          Module[{tempmean},
           Table[whichflash = RandomInteger[{0, 1}];
             If[whichflash == 1,
              leftnumsample = ArrayPlot[leftx = scon * sig
                PlotRange → {-1, 1}, ColorFunction → "Gra
              rightnumsample = ArrayPlot[rightx = ncon * r
                PlotRange → {-1, 1}, ColorFunction → "Gra
              leftnumsample = ArrayPlot[leftx = ncon * noi
                PlotRange → {-1, 1}, ColorFunction → "Gra
              rightnumsample = ArrayPlot[rightx = scon * s
                Mesh → False, PlotRange → {-1, 1}, ColorF

             flash = leftnumsample; Pause[.25]; flash = b
             flash = rightnumsample; Pause[.25]; flash = l

             myanswer = ChoiceDialog["Signal on", {"Firs
               WindowSize → {300, 80}, WindowMargins → {{

             If[myanswer == whichflash, WasICorrect = 1, W

             idealanswer =
              If[Flatten[leftx].Flatten[signal] > Flatte

             If[idealanswer == whichflash, WasIdealCorre
             data = Append[data, {WasICorrect, WasIdealC

             {numtrials}];
          ]
```

Run a block of trials

```
In[82]:= twoflashes
```

■ Take a look at the raw data

```
In[83]:= data

          ( Was I Correct?   Was Ideal Correct? )
          (       0                  1          )
          (       1                  0          )
          (       0                  1          )
          (       0                  1          )
Out[83]=  (       1                  0          )
          (       1                  1          )
          (       1                  0          )
          (       0                  1          )
          (       1                  0          )
          (       0                  0          )
```