Supplement II

Analyzing receptive field maps with spherical distributions

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Import data

```
SetDirectory("/Users/work/manuscripts/2010-method/supplement_2/product/");
<< fileIO.m
<< preprocess.m
<< visualization.m
Quiet[<< fisherbingham.m]
datafile = "13G_0#2[sph3Checker8].data";
```

xpos: the longitude of the center of the 8 x 8 grid. In degree.
ypos: the latitude of the center of the 8x8 grid. In degree.
celsize: the size of the flashing square. In degree.
duration: the ON interval of the flashing. In 0.1msec.
pause: the OFF interval following the ON interval. In 0.1msec
conditionSpkTimes: spike arrival times. In 0.1msec.

```
{xpos, ypos, cellsize, duration, pause, conditionSpkTimes} = readCheckerboard[datafile];
```
Preprocessing

- Use Quiroga’s *Event Synchronization* to find an initial estimate of the receptive field.

\[
\text{spikePatternPlot[conditionSpkTimes, duration + pause, threshold = 0.2]}
\]

{baselineRemovedSoft, baselineRemovedHard, sel, nonSel, nPerCondition, baseline} = baselineProcessing[conditionSpkTimes, duration + pause, threshold];
Mean firing rate contour plots

- A simple raster plot of the receptive field map

```math
m2 = Partition[baselineRemovedSoft, 8];
basicCheckerboardPlot[m2]
```

- Contour plot on a 3D hemisphere (Interactive)

```math
sphericalContourPlot3D[xpos, ypos, cellsize, m2, ImageSize -> 300]
```
- Lambert-projected contour plot

\[
\text{lambertContourPlot}[xpos, ypos, cellsize, m2]
\]

\[
\text{lambertContourPlot}[xpos, ypos, cellsize, m2, 
  x0 \rightarrow 30 \text{ Degree}, x1 \rightarrow 90 \text{ Degree}, y0 \rightarrow -30 \text{ Degree}, y1 \rightarrow 20 \text{ Degree}]
\]
Fitting the 5-parameter-Fisher-Bingham distribution

- **Rotation to the standard reference frame**
  
  \[ (m, t) = \text{fbGeometry}[\text{baselineRemovedHard}, \text{xpos}, \text{ypos}, \text{cellsize}]; \]

- **Fit FB5 in the standard reference frame**
  
  \[ \{c, \kappa, \beta, r^2\} = \text{fbFit}[m, t, \text{baselineRemovedSoft}, \text{xpos}, \text{ypos}, \text{cellsize}]; \]
  
  `reportFBFit[m, c, \kappa, \beta, r^2]`
  
  RF center: \((73.6^\circ, -15.3^\circ)\)
  
  eccentricity: \(74.2^\circ\)
  
  polar angle: \(-15.9^\circ\)
  
  width: \(7.8^\circ\)
  
  length: \(11.0^\circ\)
  
  quality: \(0.93\)

**Visualize fitted function**

- **As color-coded map in 3D (interactive)**
  
  `plotFB3D[{m, t, c, \kappa, \beta}]`

- **Lambert-projected contour plot**
  
  `fbm = \text{sampleFB}[\{m, t, c, \kappa, \beta\}, \text{xpos}, \text{ypos}, \text{cellsize}] // Reverse;`
Visualize the envelope (using Lambert projection)

This format is most useful for plotting many receptive fields in the same figure.

```plaintext
patch = plotFBPatchLambert[{m, t, c, kappa, beta}, PatchStyle -> Pink];
```
Show[
  lambertUnitSphere[],
  patch
]

Show[
  lambertUnitSphere[\(x_0 \rightarrow 30\) Degree, \(x_1 \rightarrow 90\) Degree, \(y_0 \rightarrow -30\) Degree, \(y_1 \rightarrow 20\) Degree],
  patch
]