<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">

<html xmlns="http://www.w3.org/1999/xhtml">

<head>

<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />

<meta http-equiv="Content-Script-Type" content="text/javascript" />

<meta name="GENERATOR" content="JustSystems Homepage Builder Version 18.0.6.0 for Windows" />

<meta http-equiv="Content-Style-Type" content="text/css" />

<link rel="stylesheet" href="main.css" type="text/css" />

<script src="d3.v3.min.js" charset="utf-8"></script>

<script type="text/javascript" src="mt.js"></script>

<script type="text/javascript" src="bayes\_funcs.js"></script>

<script type="text/javascript" src="hmm\_funcs.js"></script>

<script type="text/javascript" src="main.js"></script>

<title>HISTOGRAMS</title>

</head>

<body onload="RandomData(); Main();" style="font-family:Optima,Arial">

<div style="width:920" align="left">

<table>

<tbody>

<tr>

<td height="33" bgcolor="#ccccff" width="800"><font size="+2" face="Arial">Toolbox for constructing the best histograms </font> </td>

</tr>

</tbody>

</table>

<!-- Header --><br />

<table>

<tbody>

<tr>

<td bgcolor="#ffffcc" width="800"><font size="2pt" face="Arial">These tools provide the best histogram, kernel density estimation, Bayesian

estimator, and Hidden Markov model, for a given series of event times. Paste

or upload the event times, listed in order of increasing time, separated

by a comma or a space. Your data will not leave your computer, because

the computation is carried out on your computer. The theory applied here

for the purpose of optimizing the estimators can be found in the references.</font></td>

</tr>

</tbody>

</table>

<br />

<form name="data"><font size="2pt" face="Arial"><font size="3"><strong>1. </strong></font>You can paste your data here, or &#160; <input type="button" style="font:10.5pt Arial;" value="replace it with another sample," onclick="RandomData();Main();" /> or &#160; <input type="file" id="selfile" style="display:none;" />

<input type="button" value="upload your data." style="font:10.5pt Arial;" onclick="document.getElementById('selfile').click();" />

<script>

var obj1 = document.getElementById("selfile");

//a file is selected in a dialog box

obj1.addEventListener("change",function(evt){

var file = evt.target.files;

//making a FileReader

var reader = new FileReader();

//read in text style

reader.readAsText(file[0]);

//processing after loading

reader.onload = function(ev){

//indicating in the textarea

document.data.spikes.value = reader.result;

Main();

}

},false);

</script>

<br />

<font size = "2pt">&nbsp;&nbsp;&nbsp;&nbsp;<textarea name="spikes" rows="3" cols="120" style="font-size:9.5pt"></textarea><br />

<br />

</font><font size="3"><strong>2. </strong></font><input type="button" style="font:10.5pt Arial;" value="Estimate the rate." onclick="Main();" />

</font>

<div id="loading" style="font-size:10pt; display:inline-block; visibility:hidden"><font size="2pt" face="Arial"><img src="loading.gif" />processing...</font></div>

<font size="2pt" face="Arial"><br />

<font size="2pt">&#160;&#160;&#160;&#160;&#160;(A) Histogram: L2 risk minimization <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/papersPDF/shino2007NeCo.pdf" target="\_blank">[Reference 1]</a>. </font></font><a href="http://176.32.89.45/~hideaki/res/histogram.html" target="\_blank"><font size="2pt" face="Arial"><font size="2pt"><font face="Arial"><font size="2pt">(Related site)</font></font><br />

</font></font></a>

<div id="graph\_SS" width="800" height="60"></div>

<div id="raster\_SS" width="800" height="10"></div>

<div id="optimal\_SS" class="info"></div>

<div class="buttons">

<INPUT class="button" type="button" value="data sheet" onclick="OutputResults\_SS()" />

<INPUT class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/sshist/hist.html'" />

<a href="matlab/sshist.m" download="sshist.m">

<INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/SS\_v1.py" download="SS\_v1.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial"><font size="2pt">&#160;&#160;&#160;&#160;&#160;(B) Histogram: L2 risk minimization for <a href="http://www.jneurosci.org/content/36/21/5736">non-Poisson</a> spike trains <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/papersPDF/shino2011NeCo\_histogram.pdf" target="\_blank">[Reference 2]</a>.<br />

</font></font>

<div id="graph\_OS" width="800" height="60"></div>

<div id="raster\_OS" width="800" height="10"></div>

<div id="optimal\_OS" class="info"></div>

<div class="buttons">

<input class="button" type="button" value="data sheet" onclick="OutputResults\_OS()" />

<input class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/oshist/hist.html'" />

<a href="matlab/hist\_np\_v2.m" download="hist\_np\_v2.m">

<INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/OS\_v1.py" download="OS\_v1.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial"><font size="2pt">&#160;&#160;&#160;&#160;&#160;(C) Kernel density estimation: L2 risk minimization

<a href="https://link.springer.com/content/pdf/10.1007%2Fs10827-009-0180-4.pdf" target="\_blank">[Reference 3]</a>.<br />

</font></font>

<div id="graph\_Kernel" width="800" height="60"></div>

<div id="raster\_Kernel" width="800" height="10"></div>

<div id="optimal\_Kernel" class="info"></div>

<div class="buttons">

<INPUT class="button" type="button" value="data sheet" onclick="OutputResults\_Kernel()" />

<INPUT class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/sskernel/kernel.html'" />

<a href="matlab/sskernel\_rate\_v2.m" download="sskernel\_rate\_v2.m">

<INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/KDE\_rate\_v2.py" download="KDE\_rate\_v2.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial"><font size="2pt">&#160;&#160;&#160;&#160;&#160;(D) Kernel density estimation: L2 risk minimization

<font face="Arial"><font size="2pt"><a href="https://link.springer.com/content/pdf/10.1007%2Fs10827-009-0180-4.pdf" target="\_blank">[Reference 3]</a></font></font>, with <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/reflectedkernel/reflectedkernel.html" target="\_blank">[reflection boundary]</a>.<br />

</font></font>

<div id="graph\_Kernel2" width="800" height="60"></div>

<div id="raster\_Kernel2" width="800" height="10"></div>

<div id="optimal\_Kernel2" class="info"></div>

<div class="buttons">

<INPUT class="button" type="button" value="data sheet" onclick="OutputResults\_Kernel2()" />

<INPUT class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/reflectedkernel/reflectedkernel.html'" />

<a href="matlab/sskernel\_ref\_rate\_v2.m" download="sskernel\_ref\_rate\_v2.m"><INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/KDERB\_rate\_v2.py" download="KDERB\_rate\_v2.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial">&#160;&#160;&#160;&#160;&#160;(E) Bayesian rate estimation <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/papersPDF/shino2005JPhysA.pdf" target="\_blank">[Reference 4]</a> <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/papersPDF/shino2009NeCo.pdf" target="\_blank">[Reference 5]</a>. </font><a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/ssNeCo09/page\_SULAB2.html" target="\_blank"><font size="2pt" face="Arial">(Estimating rate and irregularity)</font></a><br />

<div id="graph\_Bayes" width="800" height="60"></div>

<div id="raster\_Bayes" width="800" height="10"></div>

<div class="buttons">

<INPUT class="button" type="button" value="data sheet" onclick="OutputResults\_Bayes()" />

<INPUT class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/ssBayes/bayes.html'" />

<a href="matlab/BayesRR.zip" download="BayesRR.zip">

<INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/BRE.py" download="BRE.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial"><font size="2pt">&#160;&#160;&#160;&#160;&#160;(F) Two-state Hidden Markov Model <a href="https://journals.aps.org/pre/abstract/10.1103/PhysRevE.89.022705" target="\_blank">[Reference 6]</a>.<br />

</font></font>

<div id="graph\_HMM" width="800" height="60"></div>

<div id="raster\_HMM" width="800" height="10"></div>

<div class="buttons">

<INPUT class="button" type="button" value="data sheet" onclick="OutputResults\_HMM()" />

<INPUT class="button" type="button" value="more detail" onclick="location.href='http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/msHMM/HMM.html'" />

<a href="matlab/HMM\_v2.m" download="HMM\_v2.m">

<INPUT class="button" type="button" value="matlab code" /></a>

<a href="python/HMM.py" download="HMM.py">

<INPUT class="button" type="button" value="python code" /></a>

</div>

<font size="2pt" face="Arial"><font size="2pt"><br />

<!--<font face="Arial Black" size=3><strong>3. Output data sheet.</strong></font>&nbsp;&nbsp;

<INPUT class="button" type="button" value="Click" onclick="OutputResults()"><br>

</FORM>

--></font></font>

<hr width="920" align="left" />

<font size="2pt" face="Arial">Computation time:

</font>

<div id="time">

</div>

<hr width="920" align="left" />

<font size="2pt" face="Arial"><br />

</font>

<div><font size="2pt" face="Arial"><font size="-1">Review article pertaining to the optimization principles and methods: <br />

<a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/papersPDF/shino2010Book.pdf" target="\_blank">Shigeru Shinomoto (2010) Estimating the firing rate. in &quot;Analysis

of Parallel Spike Train Data&quot; (eds. S. Gruen and S. Rotter) (Springer,

New York)</a>.<br />

<br />

</font></font>

<table bgcolor="#ffffcc">

<tbody>

<tr>

<td width="800" height="47" bgcolor="#cccc99"><font size="2pt" face="Arial"><font size="-1"> Individual programs were contributed by Hideaki Shimazaki, Takahiro Omi, Takeaki Shimokawa, Yasuhiro Mochizuki, Junpei Naito, and Kazuki Nakamura. For assistance, contact <a href="mailto:shinomoto@scphys.kyoto-u.ac.jp?Subject=Histograms">Shigeru Shinomoto</a>, who directed this project.<br />

</font></font></td>

</tr>

</tbody>

</table>

<br />

<table>

<tbody>

<tr>

<td align="center"><font size="2pt" face="Arial">Current version: 2.0 : 2017/10/06</font> &#160;</td>

<td align="center"><font size="2pt" face="Arial"><font color="#000000" size="2">The number of visitors since 2017/05/16: <span lang="EN-US" style="font-size:11.0pt;font-family:

Arial"><img border="0" width="40" height="10" id="\_x0000\_i1030" src="http://www.ton.scphys.kyoto-u.ac.jp/~shino/counter/count.cgi?histograms" /></span></font></font></td>

</tr>

</tbody>

</table>

</div>

</form>

<table border="0">

<tbody>

<tr>

<td bgcolor="#ccffcc" align="center" width="747" height="467"><img src="kai20070608.jpg" width="583" height="433" border="0" /></td>

</tr>

</tbody>

</table>

<font size="2pt" face="Arial"><br />

Other analytical tools: <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/toolbox/english.htm" target="\_blank">SULAB: Single Unit LABoratory<br /><br /></a>

<font face="Arial">------------------ <a href="http://www.ton.scphys.kyoto-u.ac.jp/~shino/english.html" target="\_blank">Shigeru Shinomoto, Kyoto University, Japan.</a> ----------------------------------------------------------

</font></font></div>

<br />

</body>

</html>