Bayesian Integration Visualization Tool

User Manual

I. Getting Started

A. About this Tool

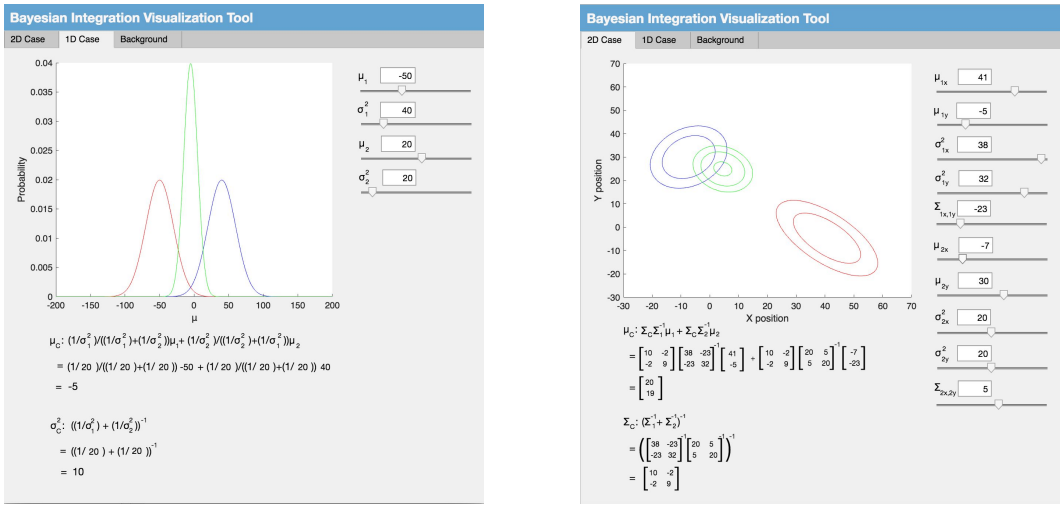
This tool serves as a way to highlight the effects of integrating two cues on predictions for position in both 1 dimension (1D) and 2 dimensions (2D) as well as a way to understand the interactions that occur in combining two cues that are Gaussian distributions in order to produce a novel distribution for a combined response cue that is due to integrating the other two cues.

B. How to Use this Tool

The tool is started up with Matlab file *BayesianTool.mlapp*, under 'App Designer' mode, and pressing the 'Run' button. Without MATLAB 2017a, install *BayesianTool.exe*. By default, the 2D case mode is shown, but one can switch between the three modes by clicking on their corresponding tabs at the top-left of the interface. The Background case is not interactive, but the 1D case and 2D case modes contain text boxes and sliders for various classifying parameters that can be manipulated.

Text boxes can be manipulated by typing in the input fields the desired numerical values for their corresponding parameters. Similarly, sliders can be manipulated by clicking and holding down the sliders and dragging them back and forth to increase or decrease their corresponding parameters. As the parameters change in the 1D and 2D case modes, the distributions change shape accordingly in the graphs that are displayed. In addition, calculations for the mean and variance (covariance instead in the 2D case) of the combined cue are updated in real time below the graphs in both cases as well as a function of the changing input parameter values.

II. App Features



Interfaces for 1D Case Mode (Left) and 2D Case Mode (Right)

A. Background Mode

This mode does not have any interactive features but instead presents two proofs that can be displayed. The distributions proof explains that because the two input cues are Gaussian, the combined cue is also distributed as Gaussian. The parameters proof shows the derivations of the parameters for the combined response cue. These conclusions are crucial for an understanding of how the mean and variance (covariance in the 2D case) of the combined cue are calculated and how the graph of the integrated distribution changes accordingly.

B. 1D Case Mode

The 1D case has adjustable parameters of mean and variance for each of the two input cues. The graph shows the probability distributions for the two input cues, with the x-axis demarcating the means of the distributions (which would correspond to their peaks graphically). The red distribution represents input cue 1, the blue distribution represents input cue 2, and the green distribution represents the combined response cue. Below the graph are calculations for the mean and variance of the combined response cue. Both the graph and the integrated cue parameter calculations are updated in real time as the input cue parameters are changed.

C. 2D Case Mode

The 2D case has adjustable parameters of mean and variance for both the x- and y-positions of each of the two input cues, as well as the covariance between the x- and y-position variables for each of the two cues. The graph shows the probability distributions for the two input cues as well as the integrated response cue, with respect to both x-position and y-position of the cues. The circles represent the variance of the distributions and the contours indicate the height of the distribution and various points. The red distribution represents input cue 1, the blue distribution represents input cue 2, and the green distribution represents the combined response cue. Below the graph are calculations for the mean and the xy-covariance of the combined response cue. Both the graph and the integrated cue parameter calculations are updated in real time as the input cue parameters are changed.

III. Troubleshooting

A. Image Generation

In the Background case mode, if the images containing the derivation for the proofs are not appearing, make sure that the files for the image, which are *Proof1.jpg* and *Proof11.jpg*, are in the same directory as the file for the tool, which is *BayesianTool.mlapp.*