Vignette

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Overview

This document serves as a tutorial to generating a .mp4 file using the functions in ConvolutionGenerator.

The functions are designed to create a visualization of the kernel, $g(\tau - t)$, "sweeping" across the input function, $f(t)$, with a live update of the convolution function $(f * g)(t)$.

The input function is assumed to be the density function of a random variable with mean zero, and $P(-b \leq X \leq b) = 1$ where b is equal to the input bound.

The function is set up such that the kernel begins off-screen with a few frames of buffer, slides

Generating Density Function

Convolution Generator has three built in functions for generating density functions that work well with the .mp4 generation function. It isn't necessary to use the provided functions, but if the user chooses to input their own function they will want to make sure they generated the function in a way that is compatible.

Our first step is creating a domain vector, which is defined over the desired plot interval. In this overview we will use the following domain:

```
x <- seq(-3, 3, by = .002)
```

We will use the density function $f(x) = |x|$ for $x \in [-1, 1]$ and $f(x) = 0$ $o.w.$. Using the absolute() function, we create an input vector of values of the function defined over our domain vector x as such:

```
func <- absolute(x, 1, -1, 1)
```

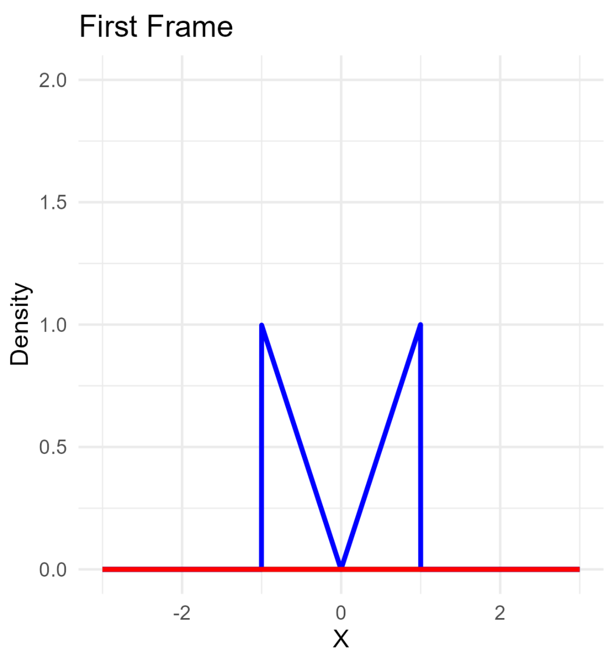
Checking Frames

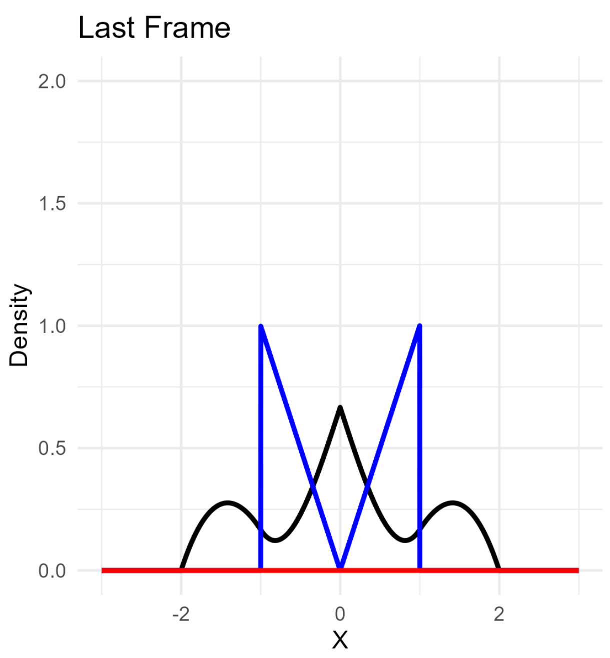
The generation of the .mp4 can take a while, so we may want to check that we have chosen an appropriate interval over which to define our function. We can use the first_frame() and last_frame() functions to ensure that we have given ourselves enough space:

```
first_frame(func, -3, 3, step_size = .002)
last_frame(func, -3, 3, step_size = .002)
```

Note that the step_size input needs to be equal to the "by" parameter we used in the seq() function, and we use the same bounds

Our output .png files should appear as the following:



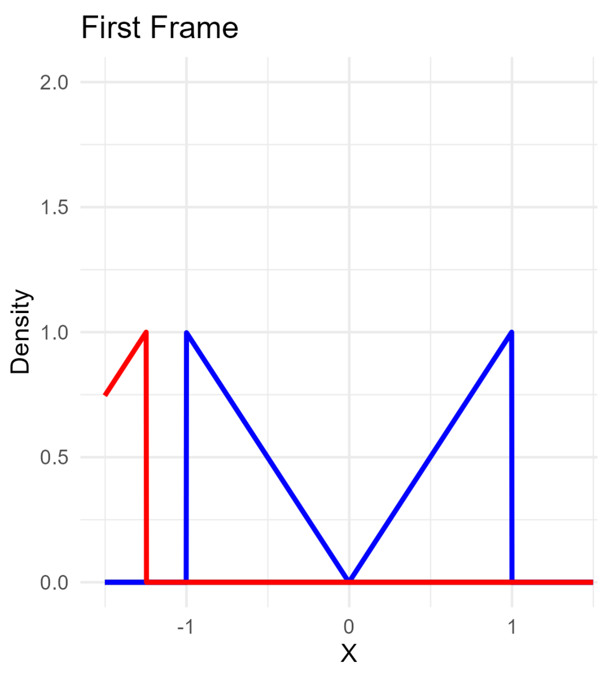
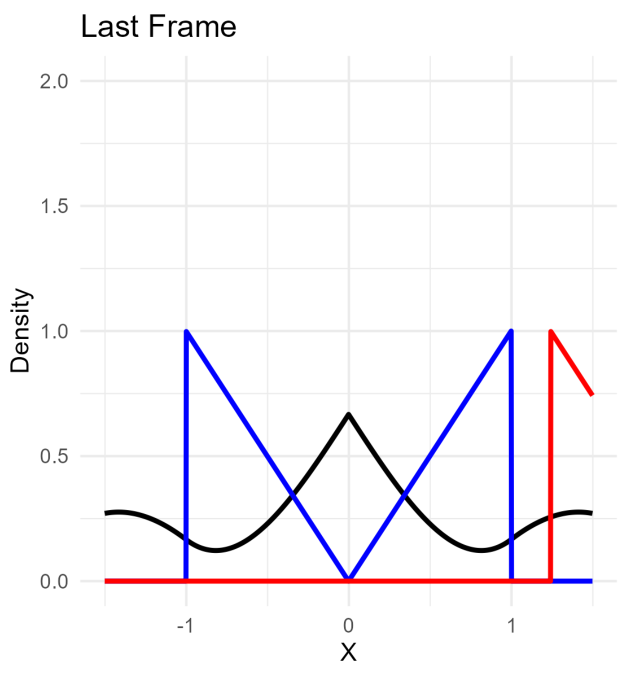


In this case everything appears good. The most likely issues we may observe arise from our choice in domain. If our domain is too large, then too much of the video will be wasted on the kernel approaching the function. If our domain is too small, then the kernel will start on-screen, which can make the video quite jarring and hard to follow.

An example of the latter:

```
x <- seq(-1.5, 1.5, by = .002)
func <- absolute(x, 1, -1, 1)

first_frame(func, -1.5, 1.5, step_size = .002)
last_frame(func, -1.5, 1.5, step_size = .002)
```


First Frame
Density
2.0
1.5
1.0
0.5
0.0
-1
0
1
X

Last Frame
Density
2.0
1.5
1.0
0.5
0.0
-1
0
1
X