Widget Basics

In this lecture we will continue to build off our understanding of **interact** and **interactive** to begin using full widgets!

What are widgets?

Widgets are eventful python objects that have a representation in the browser, often as a control like a slider, textbox, etc.

What can they be used for?

You can use widgets to build **interactive GUIs** for your notebooks.
You can also use widgets to **synchronize stateful and stateless information** between Python and JavaScript.

Using widgets

To use the widget framework, you need to import `ipywidgets`.

In [1]:
```
import ipywidgets as widgets
```

repr

Widgets have their own display `repr` which allows them to be displayed using IPython's display framework. Constructing and returning an `IntSlider` automatically displays the widget (as seen below). Widgets are displayed inside the output area below the code cell. Clearing cell output will also remove the widget.

In [2]:
```
widgets.IntSlider()
```

Failed to display Jupyter Widget of type `IntSlider`.

If you're reading this message in the Jupyter Notebook or JupyterLab Notebook, it may mean that the widgets JavaScript is still loading. If this message persists, it likely means that the widgets JavaScript library is either not installed or not enabled. See the Jupyter Widgets Documentation for setup instructions.

If you're reading this message in another frontend (for example, a static rendering on GitHub or NBViewer), it may mean that your frontend doesn't currently support widgets.

display()

You can also explicitly display the widget using `display(...)`.

In [3]:
```
from IPython.display import display
w = widgets.IntSlider()
display(w)
```

Failed to display Jupyter Widget of type `IntSlider`.

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Multiple display() calls

If you display the same widget twice, the displayed instances in the front-end will remain in sync with each other. Try dragging the slider below and watch the slider above.

In [4]:
```
display(w)
```

Failed to display Jupyter Widget of type `IntSlider`.

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Closing widgets

You can close a widget by calling its `close()` method.

In [5]:
```
display(w)
```

Failed to display Jupyter Widget of type `IntSlider`.

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In [6]:
```
w.close()
```

Widget properties

All of the IPython widgets share a similar naming scheme. To read the value of a widget, you can query its `value` property.

In [7]:
```
w = widgets.IntSlider()
display(w)
```

Failed to display Jupyter Widget of type `IntSlider`.

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In [8]:
```
w.value
```

Out[8]:
```
0
```

Similarly, to set a widget's value, you can set its `value` property.

In [9]:
```
w.value = 100
```

Keys

In addition to `value`, most widgets share `keys`, `description`, and `disabled`. To see the entire list of synchronized, stateful properties of any specific widget, you can query the `keys` property.

In [10]:
```
w.keys
```

Out[10]:
```
['_dom_classes',
 '_model_module',
 '_model_module_version',
 '_model_name',
 '_view_count',
 '_view_module',
 '_view_module_version',
 '_view_name',
 'continuous_update',
 'description',
 'disabled',
 'layout',
 'max',
 'min',
 'orientation',
 'readout',
 'readout_format',
 'step',
 'style',
 'value']
```

Shorthand for setting the initial values of widget properties

While creating a widget, you can set some or all of the initial values of that widget by defining them as keyword arguments in the widget's constructor (as seen below).

In [12]:
```
widgets.Text(value='Hello World!', disabled=True)
```

Failed to display Jupyter Widget of type `Text`.

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Linking two similar widgets

If you need to display the same value two different ways, you'll have to use two different widgets. Instead of attempting to manually synchronize the values of the two widgets, you can use the `link` or `jslink` function to link two properties together (the difference between these is discussed in Widget Events). Below, the values of two widgets are linked together.

In [13]:
```
a = widgets.FloatText()
b = widgets.FloatSlider()
display(a,b)

mylink = widgets.jslink((a, 'value'), (b, 'value'))
```

Failed to display Jupyter Widget of type `FloatText`.

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Failed to display Jupyter Widget of type `FloatSlider`.

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Unlinking widgets

Unlinking the widgets is simple. All you have to do is call `.unlink` on the link object. Try changing one of the widgets above after unlinking to see that they can be independently changed.

In [14]:
```
mylink.unlink()
```

Conclusion

You should now be beginning to have an understanding of how Widgets can interact with each other and how you can begin to specify widget details.