Histograms in Python

How to make Histograms in Python with Plotly.

New to Plotly?

In statistics, a histogram (https://en.wikipedia.org/wiki/Histogram) is representation of the distribution of numerical data, where the data are binned and the count for each bin is represented. More generally, in Plotly a histogram is an aggregated bar chart, with several possible aggregation functions (e.g. sum, average, count...) which can be used to visualize data on categorical and date axes as well as linear axes.

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Alternatives to histogram plots for visualizing distributions include violin plots (https://plotly.com/python/violin/), box plots (https://plotly.com/python/box-plots/), ECDF plots (https://plotly.com/python/ecdf-plots/) and strip charts (https://plotly.com/python/strip-charts/).

> If you're looking instead for bar charts, i.e. representing *raw, unaggregated* data with rectangular bar, go to the Bar Chart tutorial (/python/bar-charts/).

Histograms with Plotly Express

plotly-express/) is the easy-to-use, high-level interface to Plotly, which types of data (/python/px-arguments/) and produces easy-to-style plotly-express/).

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill")
fig.show()
```

```
import plotly.express as px
df = px.data.tips()
# Here we use a column with categorical data
fig = px.histogram(df, x="day")
fig.show()
```

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Choosing the number of bins

f bins is chosen so that this number is comparable to the typical

bin. This number can be customized, as well as the range of values.

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", nbins=20)
fig.show()
```

values

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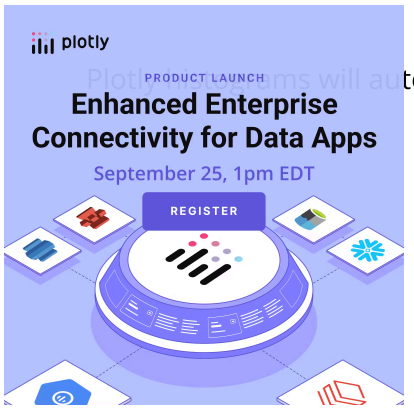
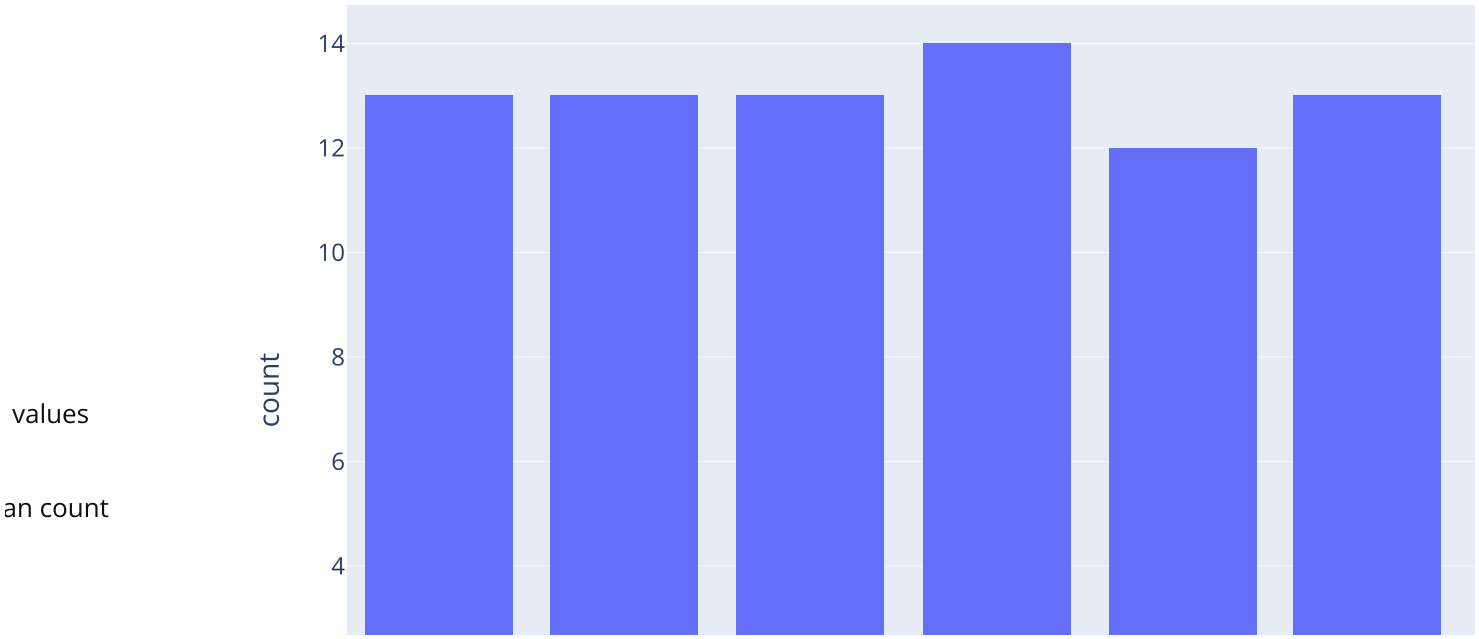
Histograms on Date Data



Plotly histograms will automatically bin date data in addition to numerical data:

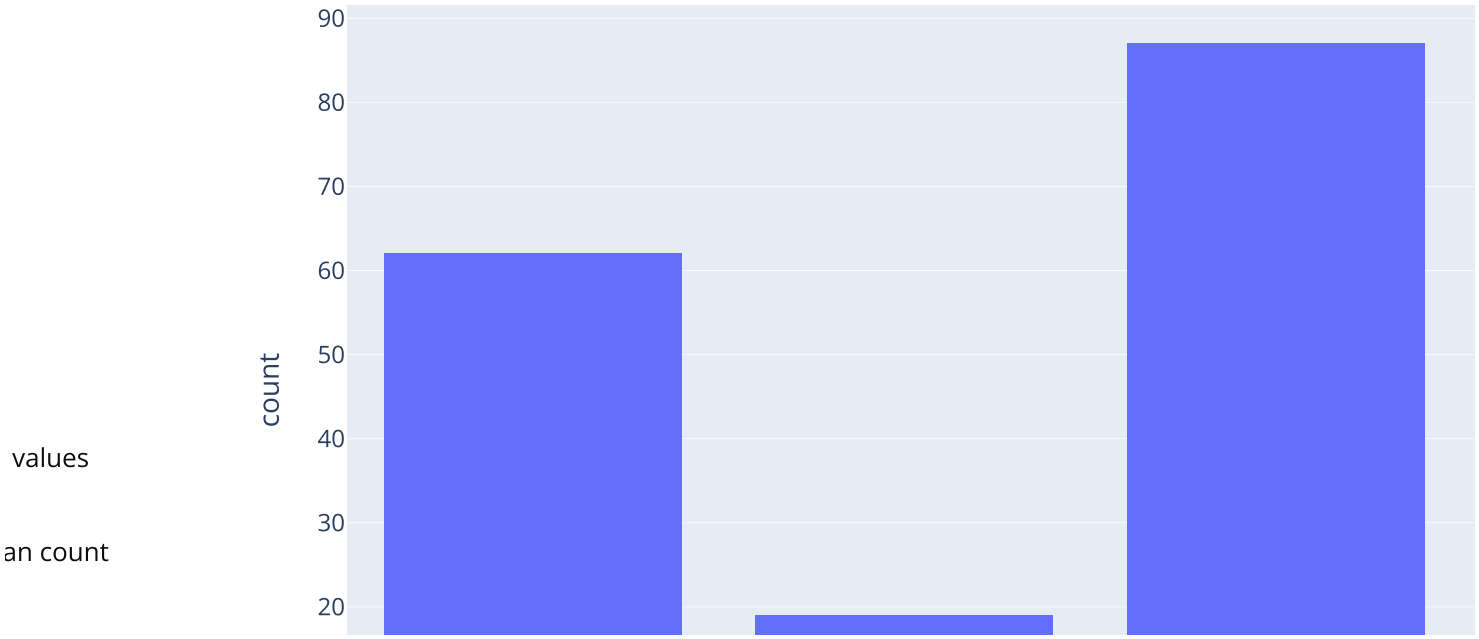
```
import plotly.express as px

df = px.data.stocks()
fig = px.histogram(df, x="date")
fig.update_layout(bargap=0.2)
fig.show()
```



Histograms on Categorical Data

Plotly Express will automatically bin numerical or date data but can also be used on raw categorical data, as in the following example, where the X-axis value is the categorical "day"

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="day", category_orders=dict(day=["Thur", "Fri", "Sa
t", "Sun"]))
fig.show()
```



Histograms in Dash

Dash (https://plotly.com/dash/) is the best way to build analytical apps in Python using Plotly figures. To run the app below, run pip install dash, click "Download" to get the code and run python app.py.

Get started with the official Dash docs (https://dash.plotly.com/installation) and **learn how to effortlessly** style (https://plotly.com/dash/design-kit/) **&** deploy (https://plotly.com/dash/app-manager/) **apps like this with** Dash Enterprise (https://plotly.com/dash/)**.**

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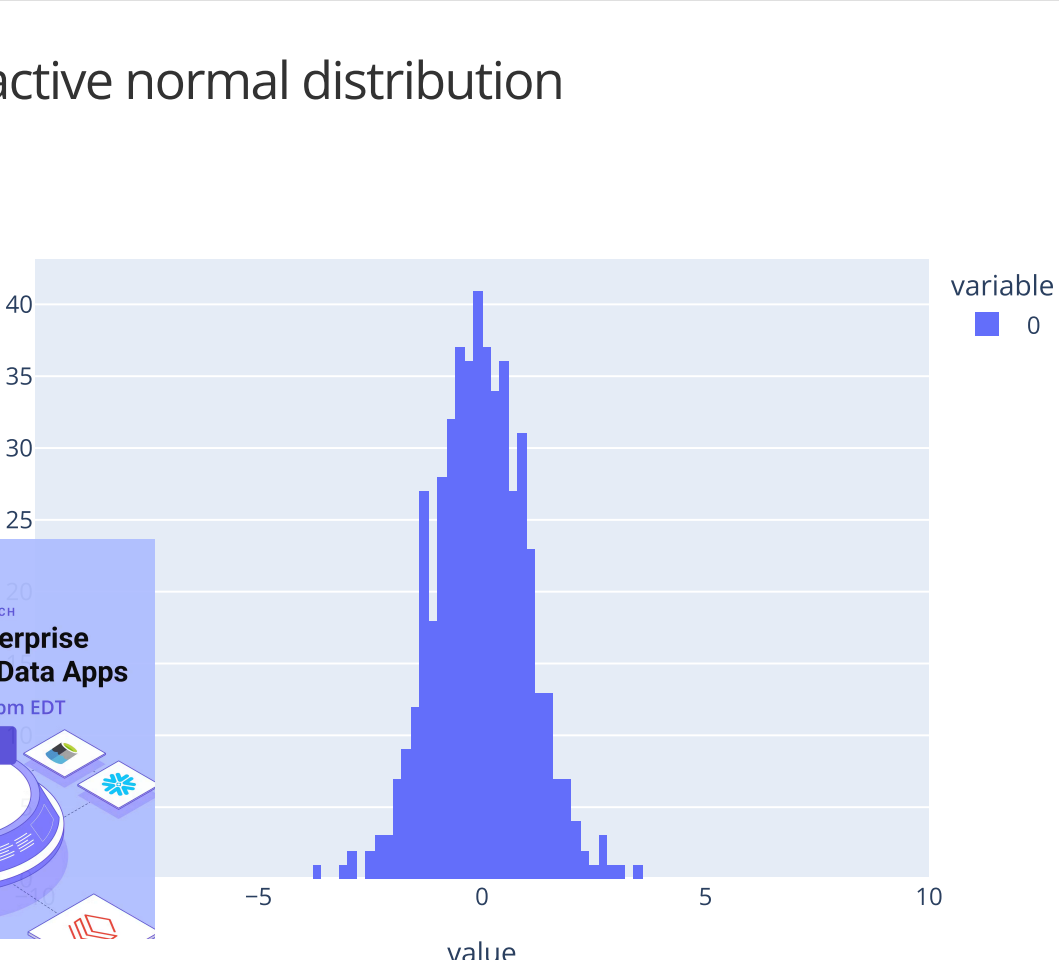
```
from dash import Dash, dcc, html, Input, Output
import plotly.express as px
import numpy as np

app = Dash(__name__)


app.layout = html.Div([
    html.H4('Interactive normal distribution'),
    dcc.Graph(id="graph"),
    html.P("Mean:"),
    dcc.Slider(id="mean", min=-3, max=3, value=0,
               marks={-3: '-3', 3: '3'}),
    html.P("Standard Deviation:"),
    dcc.Slider(id="std", min=1, max=3, value=1,
               marks={1: '1', 3: '3'}),
])


@app.callback(
    Output("graph", "figure"),
    Input("mean", "value"),
    Input("std", "value"))
def display_color(mean, std):
    data = np.random.normal(mean, std, size=500) # replace with your own data source
```

DOWNLOAD

values

an count



Mean:

-3 3

Standard Deviation:

1 3

Sign up for Dash Club → Free cheat sheets plus updates from Chris Parmer and Adam Schroeder delivered to your inbox every two months. Includes tips and tricks, community apps, and deep dives into the Dash architecture. Join now (https://go.plotly.com/dash-club?utm_source=Dash+Club+2022&utm_medium=graphing_libraries&utm_content=inline).

Accessing the counts (y-axis) values

values

JavaScript calculates the y-axis (count) values on the fly in the browser, so it's not accessible in the fig. You can manually calculate it using np.histogram.

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```
import plotly.express as px
import numpy as np

df = px.data.tips()
# create the bins
counts, bins = np.histogram(df.total_bill, bins=range(0, 60, 5))
bins = 0.5 * (bins[:-1] + bins[1:])

fig = px.bar(x=bins, y=counts, labels={'x':'total_bill', 'y':'count'})
fig.show()
```

values

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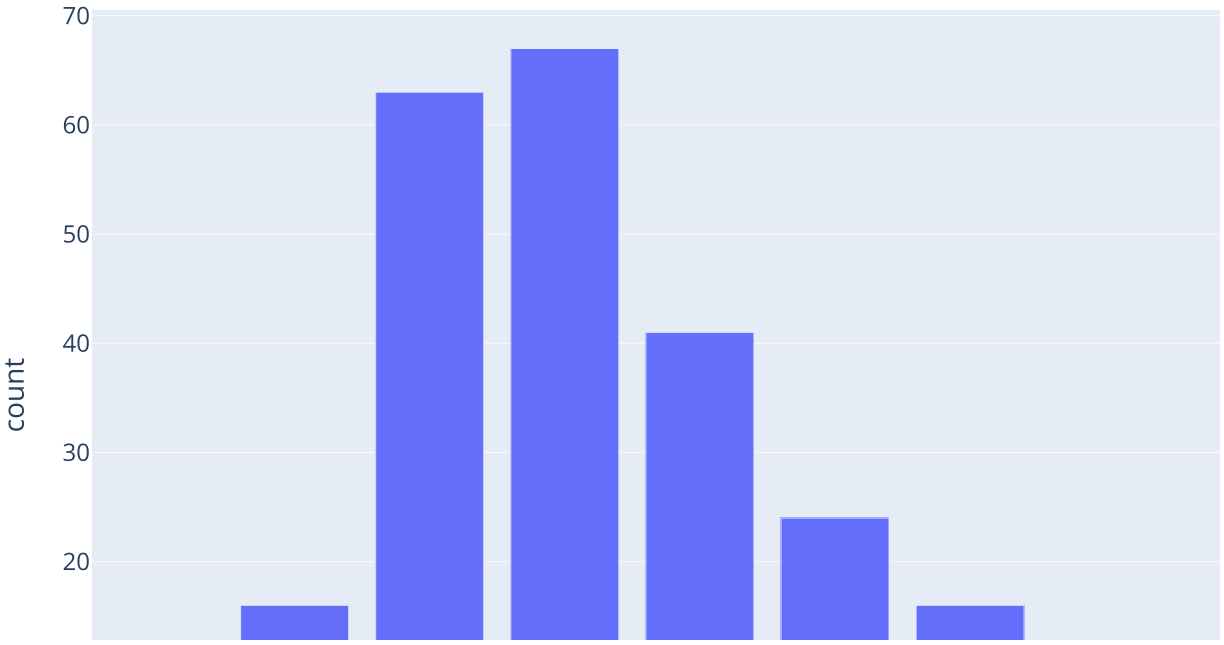
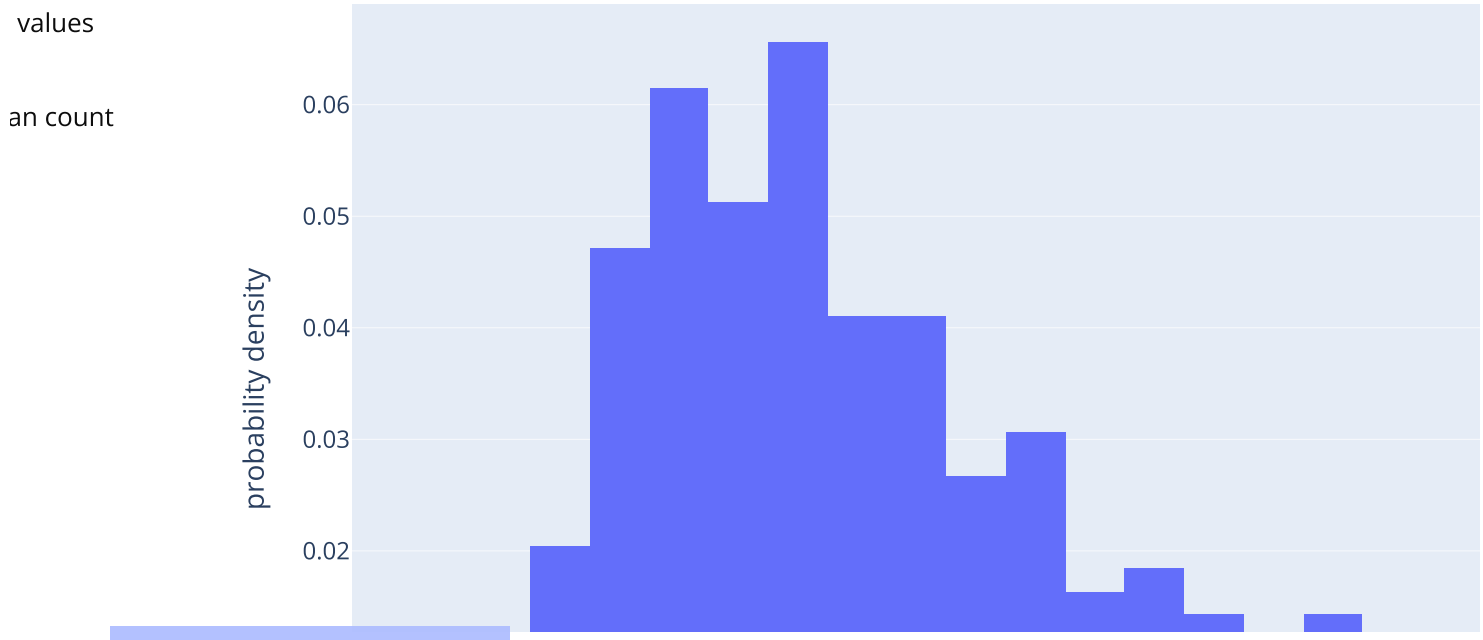


Type of normalization

The default mode is to represent the count of samples in each bin. With the histnorm argument, it is also possible to represent the percentage or fraction of samples in each bin (histnorm='percent' or probability), or a density histogram (the sum of all bar areas equals the total number of sample points, density), or a probability density histogram (the sum of all bar areas equals 1, probability density).

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", histnorm='probability density')
fig.show()
```



Aspect of the histogram plot

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill",
                   title='Histogram of bills',
                   labels={'total_bill':'total bill'}, # can specify one lab
el per df column
                   opacity=0.8,
                   log_y=True, # represent bars with log scale
                   color_discrete_sequence=['indianred'] # color of histogra
m bars
                   )
fig.show()
```

values

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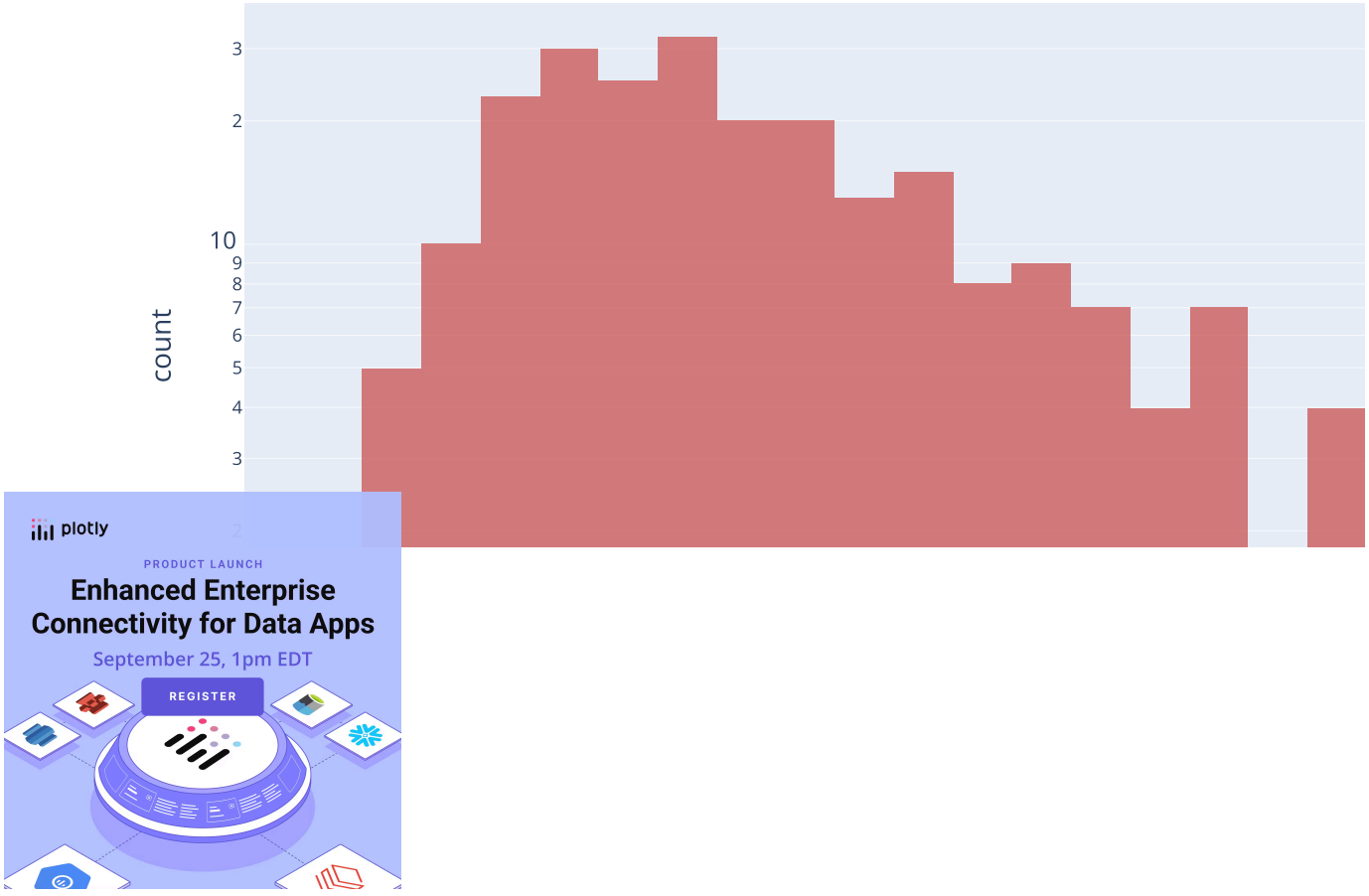
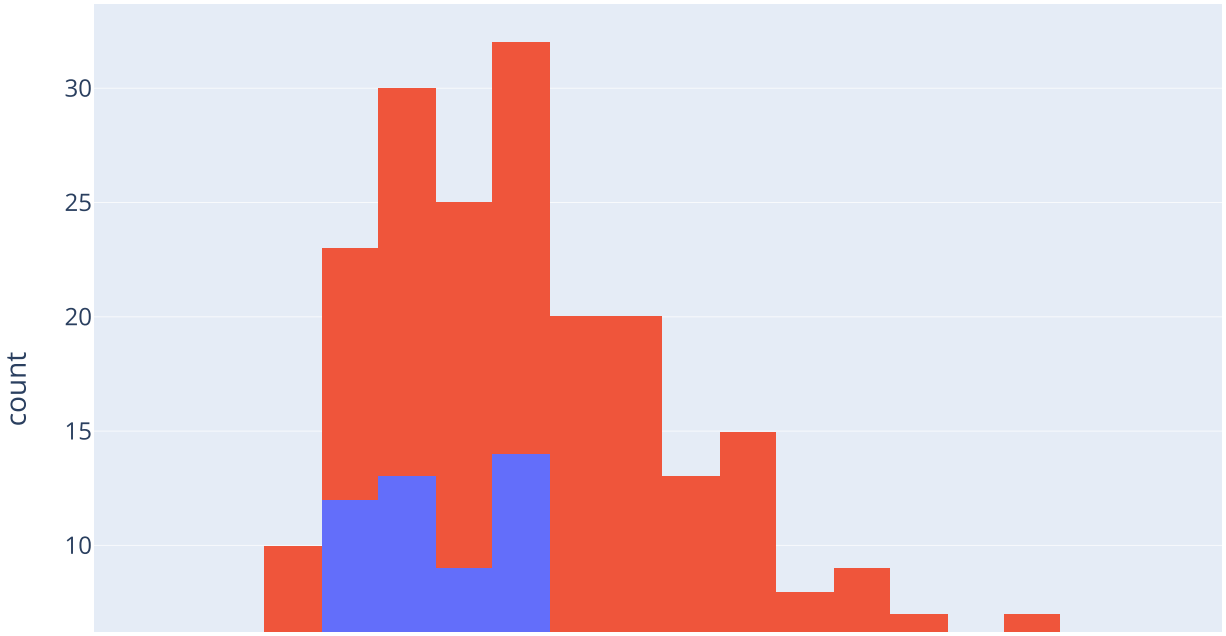


Several histograms for the different values of one column

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", color="sex")
fig.show()
```



values

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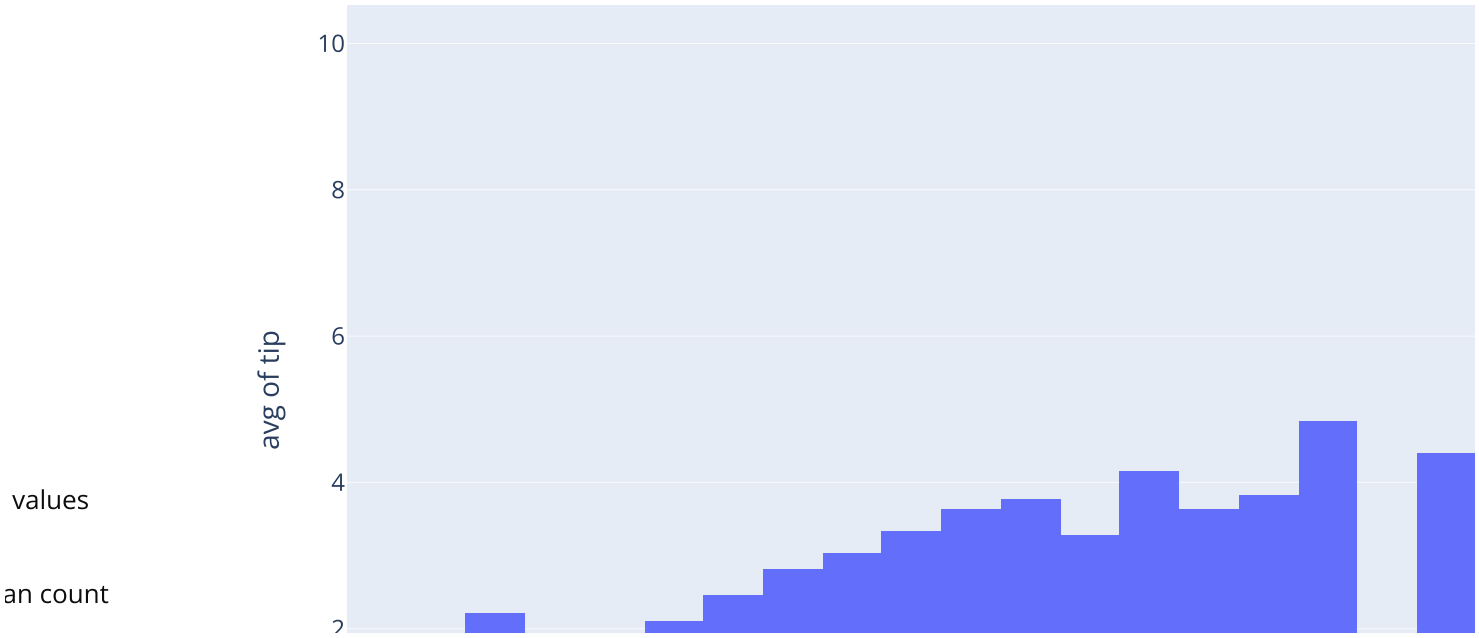
h other functions than count

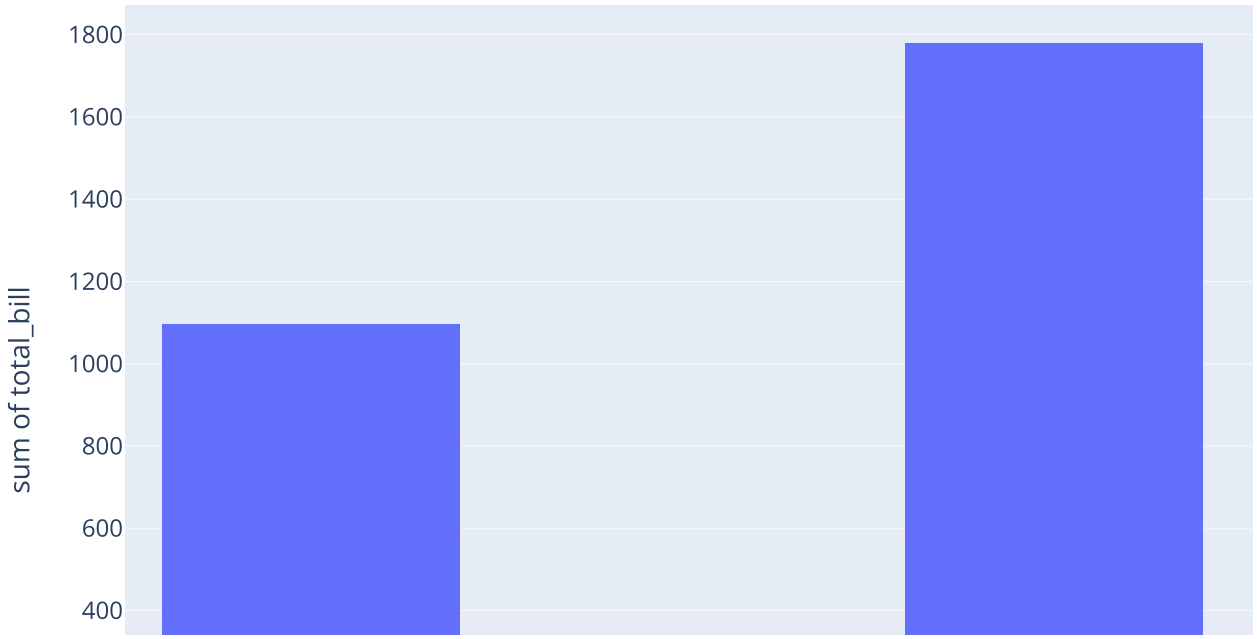
n compute a function of data using histfunc. The argument of histfunc given as the y argument. Below the plot shows that the average ti
ill.

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", y="tip", histfunc='avg')
fig.show()
```



The default histfunc is sum if y is given, and works with categorical as well as binned numeric data on the x axis:

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="day", y="total_bill", category_orders=dict(day=["T
hur", "Fri", "Sat", "Sun"]))
fig.show()
```



values

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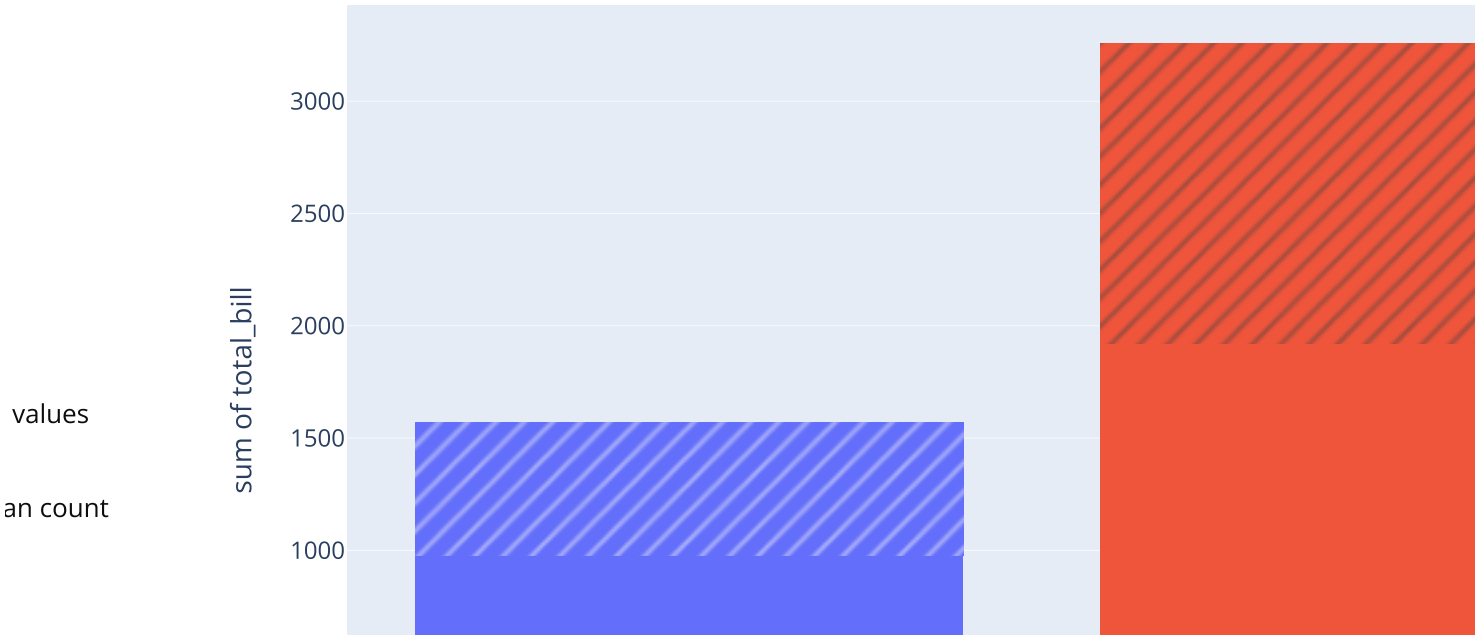
New in v5.0

Histograms also afford the use of patterns (also known as hatching or texture) (/python/pattern-

addition to color:

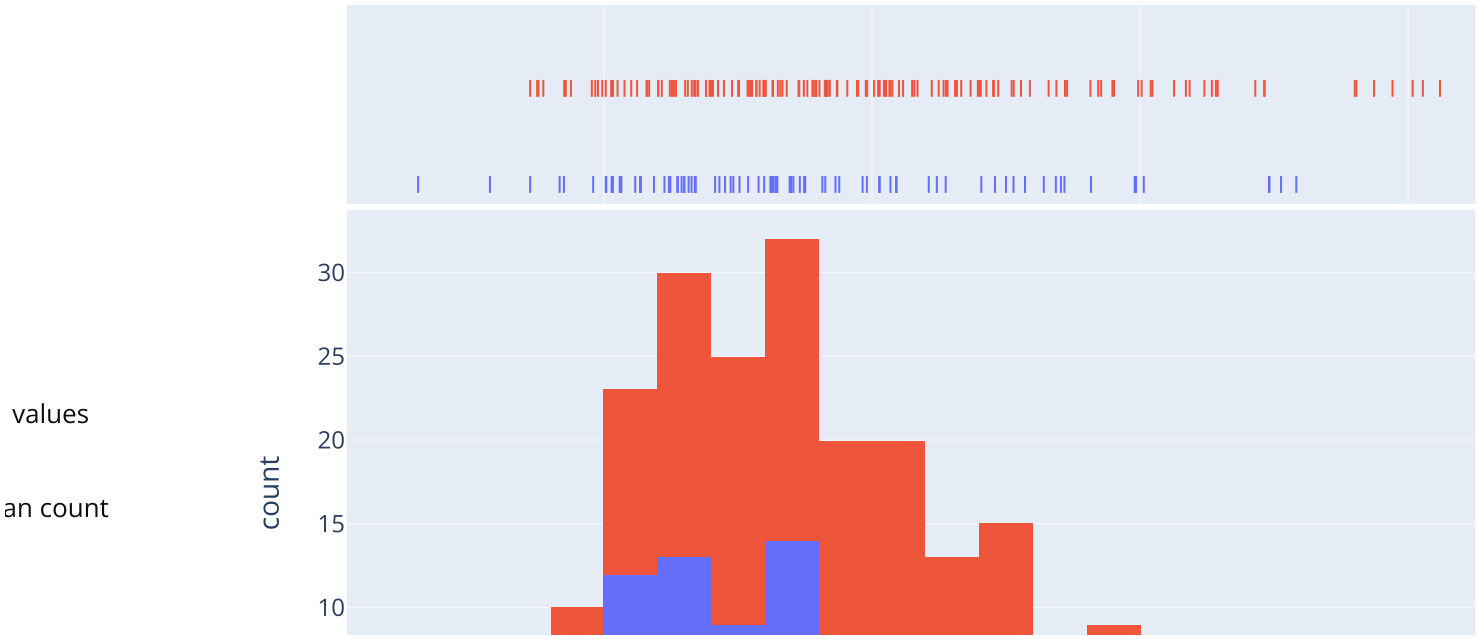
```
import plotly.express as px

df = px.data.tips()
fig = px.histogram(df, x="sex", y="total_bill", color="sex", pattern_shape
="smoker")
fig.show()
```



distribution

rd, a marginal (https://plotly.com/python/marginal-plots/) is drawn
, visualizing the distribution. See the distplot page
n/distplot/) for more examples of combined statistical representations.

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", color="sex", marginal="rug", # can be `box`, `violin`
                         hover_data=df.columns)
fig.show()
```

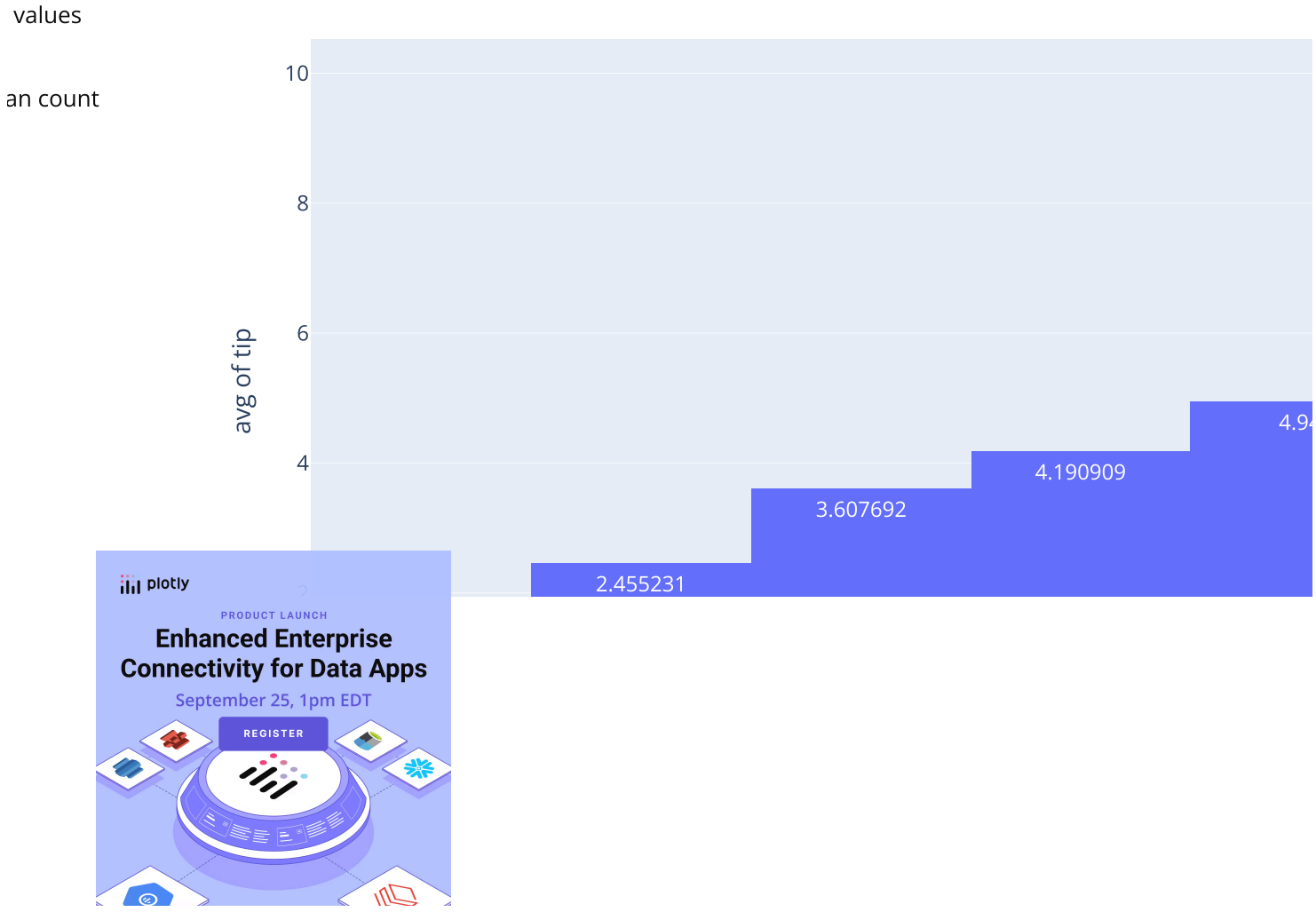


Adding text labels

New in v5.5

You can add text to histogram bars using the text_auto argument. Setting it to True will display the values on the bars, and setting it to a d3-format formatting string will control the output format.

```
import plotly.express as px
df = px.data.tips()
fig = px.histogram(df, x="total_bill", y="tip", histfunc="avg", nbins=8, tex
t_auto=True)
fig.show()
```



Histograms with go.Histogram

If Plotly Express does not provide a good starting point, it is also possible to use the more generic go.Histogram class from plotly.graph_objects (/python/graph-objects/). All of the available histogram options are described in the histogram section of the reference page: https://plotly.com/python/reference#histogram (https://plotly.com/python/reference#histogram).

Basic Histogram

values

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```
import plotly.graph_objects as go

import numpy as np
np.random.seed(1)

x = np.random.randn(500)

fig = go.Figure(data=[go.Histogram(x=x)])
fig.show()
```

values

an count

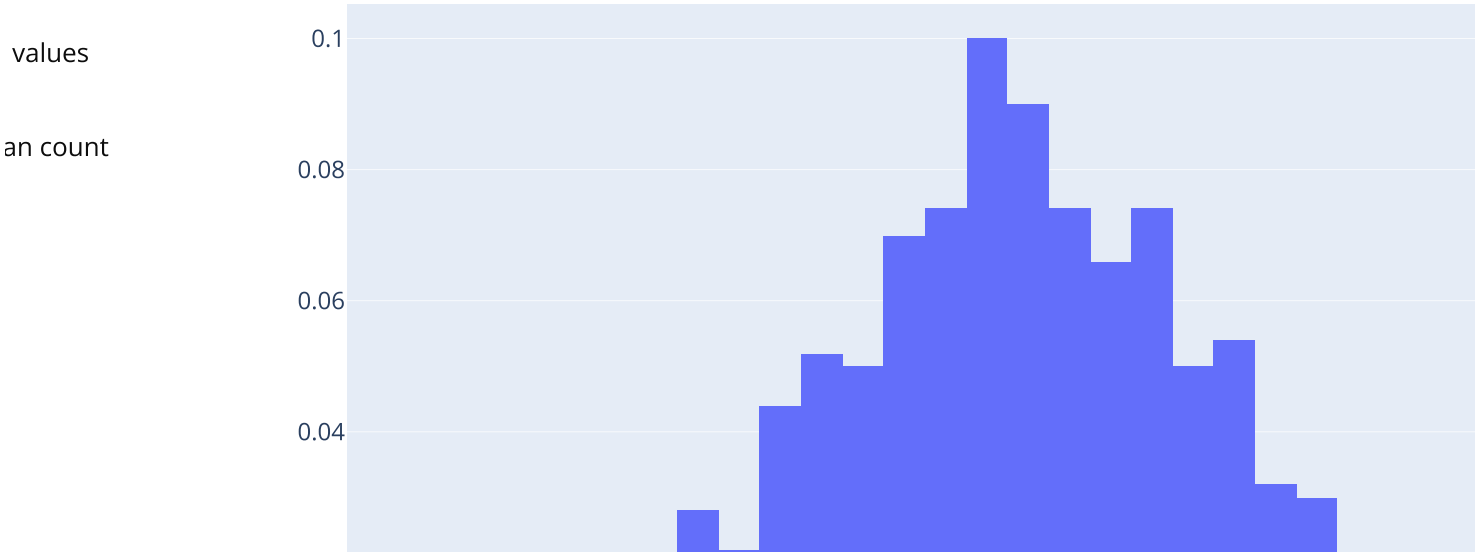
Normalized Histogram

```
import plotly.graph_objects as go

import numpy as np

x = np.random.randn(500)
fig = go.Figure(data=[go.Histogram(x=x, histnorm='probability')])

fig.show()
```



Horizontal Histogram

```
import plotly.graph_objects as go

import numpy as np

y = np.random.randn(500)
# Use `y` argument instead of `x` for horizontal histogram

fig = go.Figure(data=[go.Histogram(y=y)])
fig.show()
```

Overlaid Histogram

```
import plotly.graph_objects as go

import numpy as np

x0 = np.random.randn(500)
# Add 1 to shift the mean of the Gaussian distribution
x1 = np.random.randn(500) + 1

fig = go.Figure()
fig.add_trace(go.Histogram(x=x0))
fig.add_trace(go.Histogram(x=x1))

# Overlay both histograms
fig.update_layout(barmode='overlay')
# Reduce opacity to see both histograms
fig.update_traces(opacity=0.75)
fig.show()
```

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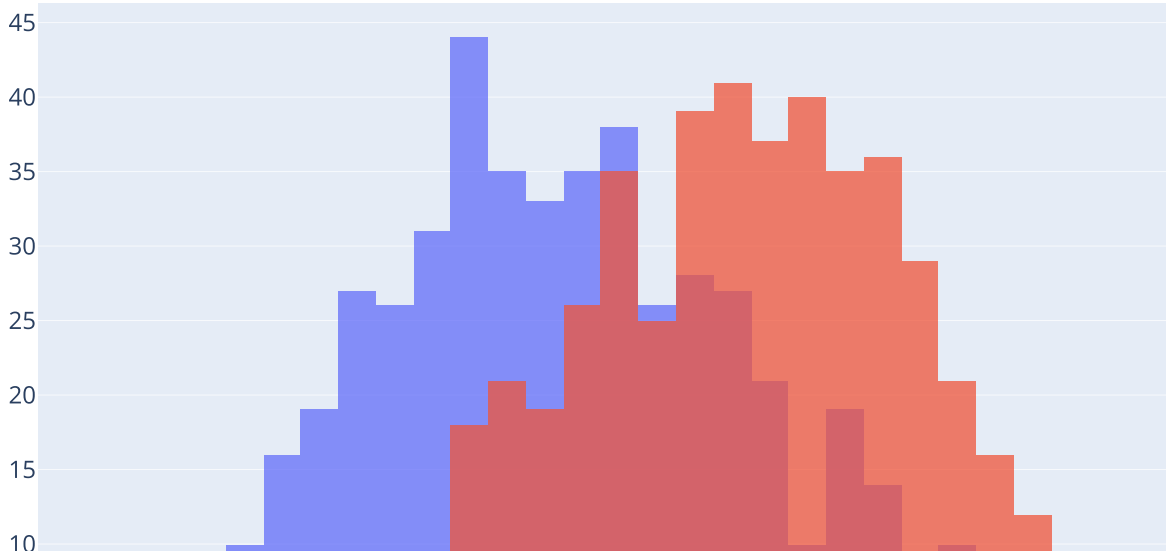

values

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Stacked Histograms

```
import plotly.graph_objects as go

import numpy as np

x0 = np.random.randn(2000)
x1 = np.random.randn(2000) + 1

fig = go.Figure()
fig.add_trace(go.Histogram(x=x0))
fig.add_trace(go.Histogram(x=x1))

# The two histograms are drawn on top of another
fig.update_layout(barmode='stack')
fig.show()
```

values

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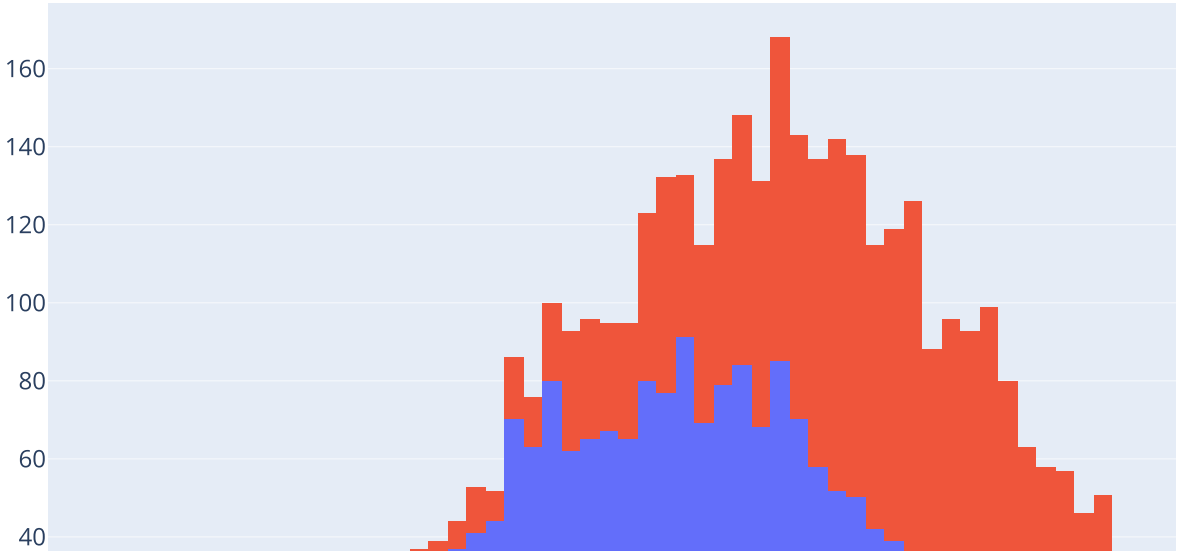

values

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Styled Histogram

```
import plotly.graph_objects as go

import numpy as np
x0 = np.random.randn(500)
x1 = np.random.randn(500) + 1

fig = go.Figure()
fig.add_trace(go.Histogram(
    x=x0,
    histnorm='percent',
    name='control', # name used in legend and hover labels
    xbins=dict( # bins used for histogram
        start=-4.0,
        end=3.0,
        size=0.5
    ),
    marker_color='#EB89B5',
    opacity=0.75
))
fig.add_trace(go.Histogram(
    x=x1,
    histnorm='percent',
    name='experimental',
    xbins=dict(
        start=-3.0,
        end=4,
        size=0.5
    ),
    marker_color='#330C73',
    opacity=0.75
))

fig.update_layout(title_text='Sampled Results', # title of plot
                  xaxis_title_text='Value', # xaxis label
                  yaxis_title_text='Count', # yaxis label
                  bargap=0.2, # gap between bars of adjacent location coordinates
                  bargroupgap=0.1 # gap between bars of the same location coordinates
)
```

values

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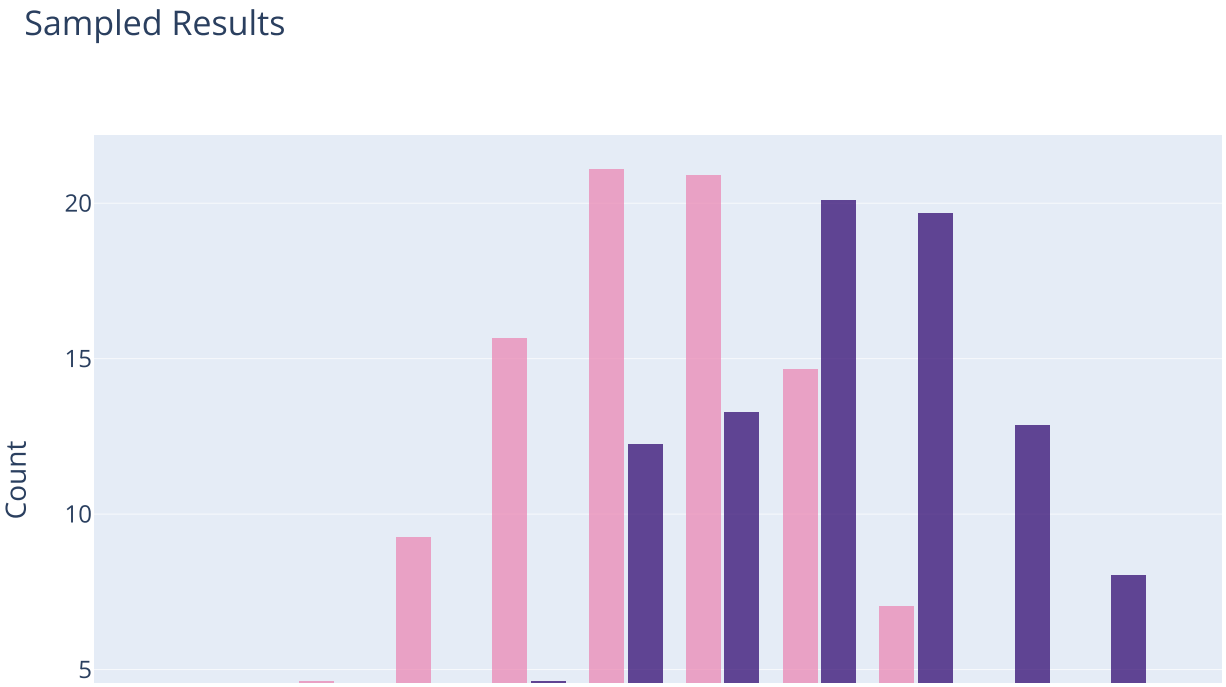
```
)

fig.show()
```



values

an count

Histogram Bar Text

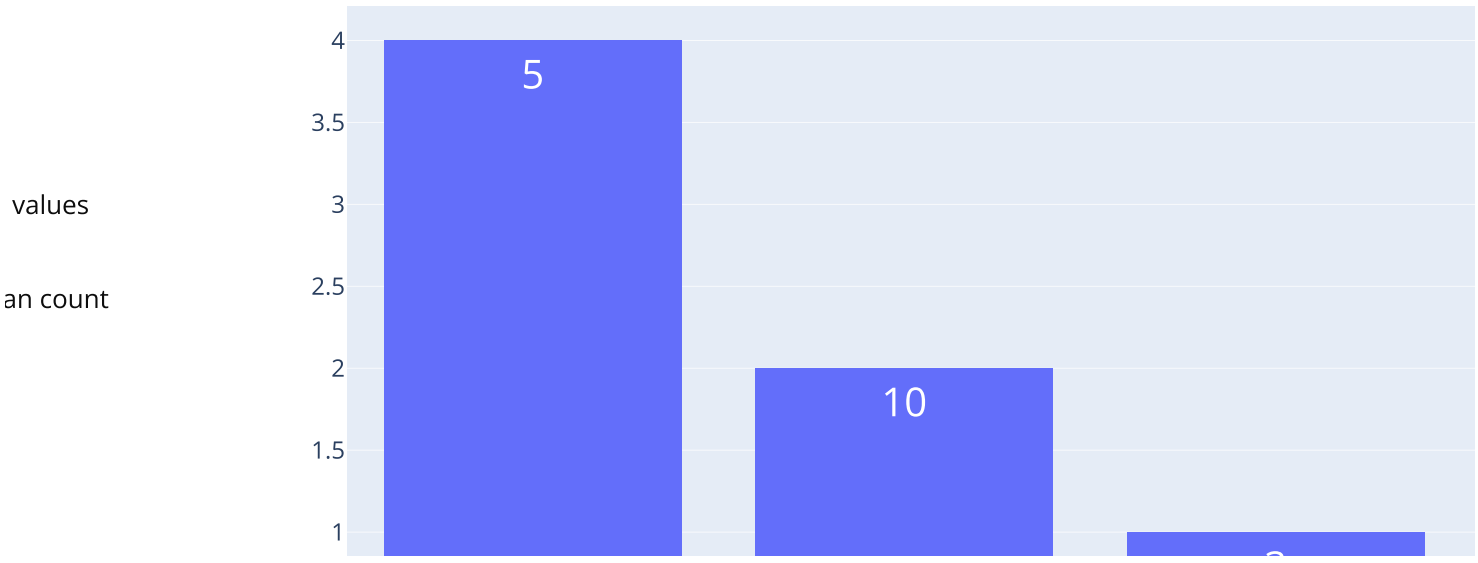
You can add text to histogram bars using the texttemplate argument. In this example we add the x-axis values as text following the format %{variable}. We also adjust the size of the text using textfont_size.

```
import plotly.graph_objects as go

numbers = ["5", "10", "3", "10", "5", "8", "5", "5"]

fig = go.Figure()
fig.add_trace(go.Histogram(x=numbers, name="count", texttemplate="%{x}", tex
tfont_size=20))

fig.show()
```



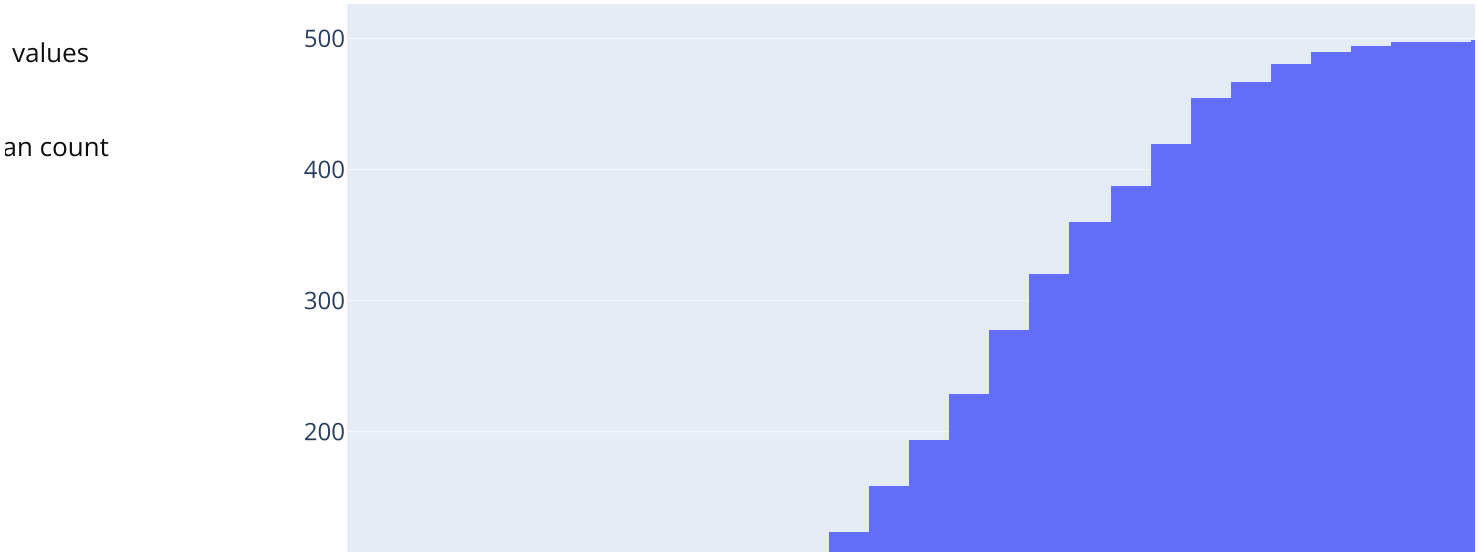
Cumulative Histogram

```
import plotly.graph_objects as go

import numpy as np

x = np.random.randn(500)
fig = go.Figure(data=[go.Histogram(x=x, cumulative_enabled=True)])

fig.show()
```



Specify Aggregation Function

```
import plotly.graph_objects as go

x = ["Apples","Apples","Apples","Oranges", "Bananas"]
y = ["5","10","3","10","5"]

fig = go.Figure()
fig.add_trace(go.Histogram(histfunc="count", y=y, x=x, name="count"))
fig.add_trace(go.Histogram(histfunc="sum", y=y, x=x, name="sum"))

fig.show()
```

values

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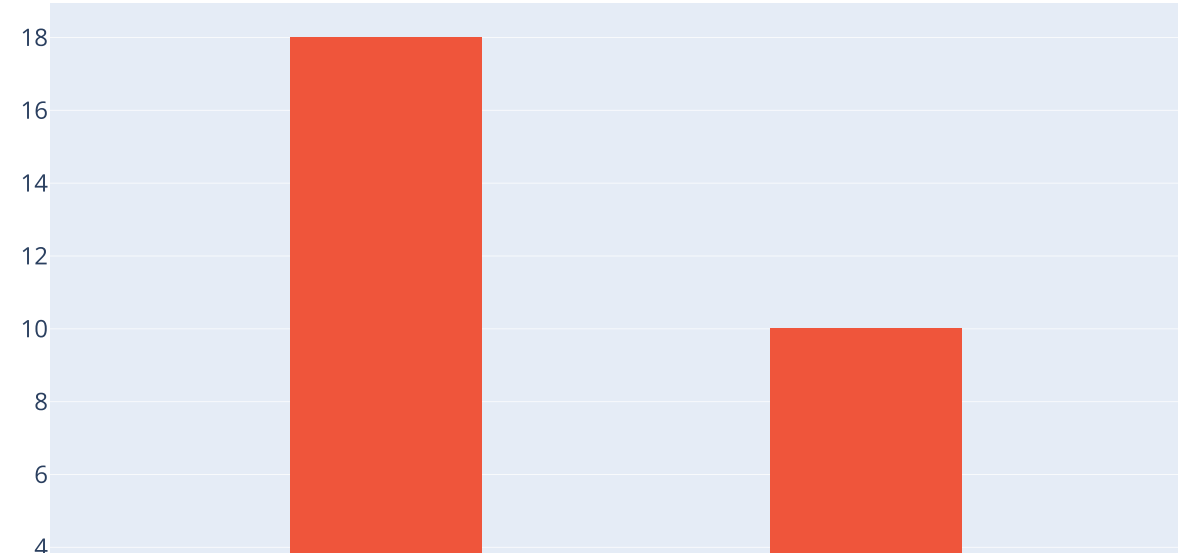

Custom Binning

For custom binning along x-axis, use the attribute nbinsx (https://plotly.com/python/reference/histogram/#histogram-nbinsx). Please note that the autobin algorithm will choose a 'nice' round bin size that may result in somewhat fewer than nbinsx total bins. Alternatively, you can set the exact values for xbins (https://plotly.com/python/reference/histogram/#histogram-xbins) along with autobinx = False.

values

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```
import plotly.graph_objects as go
from plotly.subplots import make_subplots

x = ['1970-01-01', '1970-01-01', '1970-02-01', '1970-04-01', '1970-01-02',
     '1972-01-31', '1970-02-13', '1971-04-19']

fig = make_subplots(rows=3, cols=2)

trace0 = go.Histogram(x=x, nbinsx=4)
trace1 = go.Histogram(x=x, nbinsx = 8)
trace2 = go.Histogram(x=x, nbinsx=10)
trace3 = go.Histogram(x=x,
                      xbins=dict(
                      start='1969-11-15',
                      end='1972-03-31',
                      size='M18'), # M18 stands for 18 months
                      autobinx=False
                     )
trace4 = go.Histogram(x=x,
                      xbins=dict(
                      start='1969-11-15',
                      end='1972-03-31',
                      size='M4'), # 4 months bin size
                      autobinx=False
                      )
trace5 = go.Histogram(x=x,
                      xbins=dict(
                      start='1969-11-15',
                      end='1972-03-31',
                      size= 'M2'), # 2 months
                      autobinx = False
                      )

fig.append_trace(trace0, 1, 1)
fig.append_trace(trace1, 1, 2)
fig.append_trace(trace2, 2, 1)
fig.append_trace(trace3, 2, 2)
fig.append_trace(trace4, 3, 1)
fig.append_trace(trace5, 3, 2)
```

values

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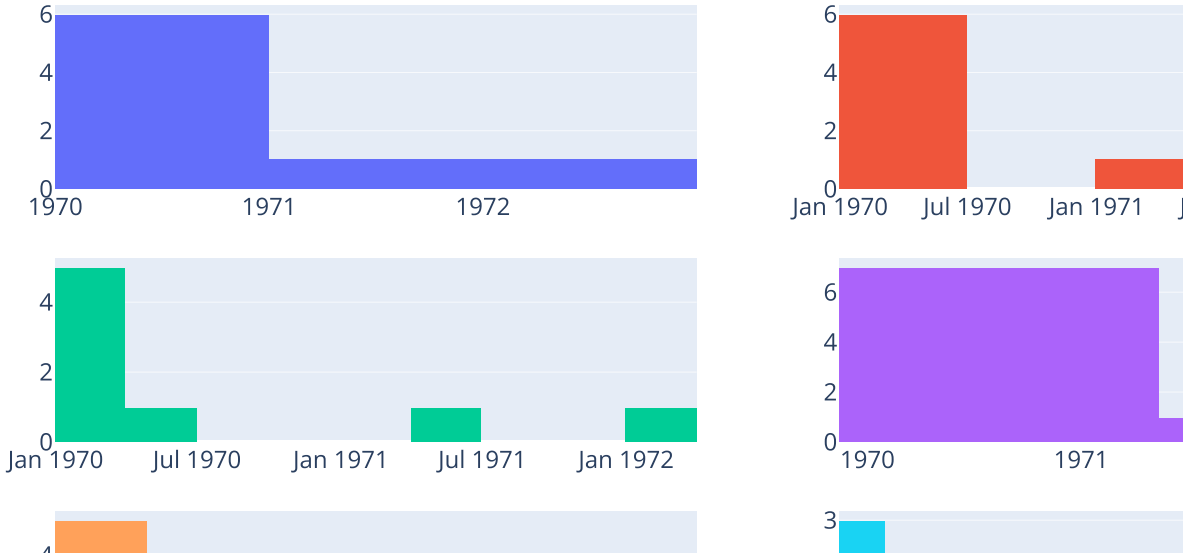

values

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See also: Bar Charts

If you want to display information about the individual items within each histogram bar, then create a stacked bar chart with hover information as shown below. Note that this is not technically the histogram chart type, but it will have a similar effect as shown below by comparing the output of px.histogram and px.bar. For more information, see the tutorial on bar charts (/python/bar-charts/).

```
import plotly.express as px
df = px.data.tips()
fig1 = px.bar(df, x='day', y='tip', height=300,
              title='Stacked Bar Chart - Hover on individual items')
fig2 = px.histogram(df, x='day', y='tip', histfunc='sum', height=300,
                    title='Histogram Chart')
fig1.show()
fig2.show()
```

values

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Share bins between histograms

In this example both histograms have a compatible bin settings using bingroup (https://plotly.com/python/reference/histogram/#histogram-bingroup) attribute. Note that traces on the same subplot, and with the same barmode ("stack", "relative", "group") are forced into the same bingroup, however traces with barmode = "overlay" and on different axes (of the same axis type) can have compatible bin settings. Histogram and histogram2d (https://plotly.com/python/2D-Histogram/) trace can share the same bingroup.

values

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```
import plotly.graph_objects as go
import numpy as np

fig = go.Figure(go.Histogram(
    x=np.random.randint(7, size=100),
    bingroup=1))

fig.add_trace(go.Histogram(
    x=np.random.randint(7, size=20),
    bingroup=1))

fig.update_layout(
    barmode="overlay",
    bargap=0.1)

fig.show()
```

values

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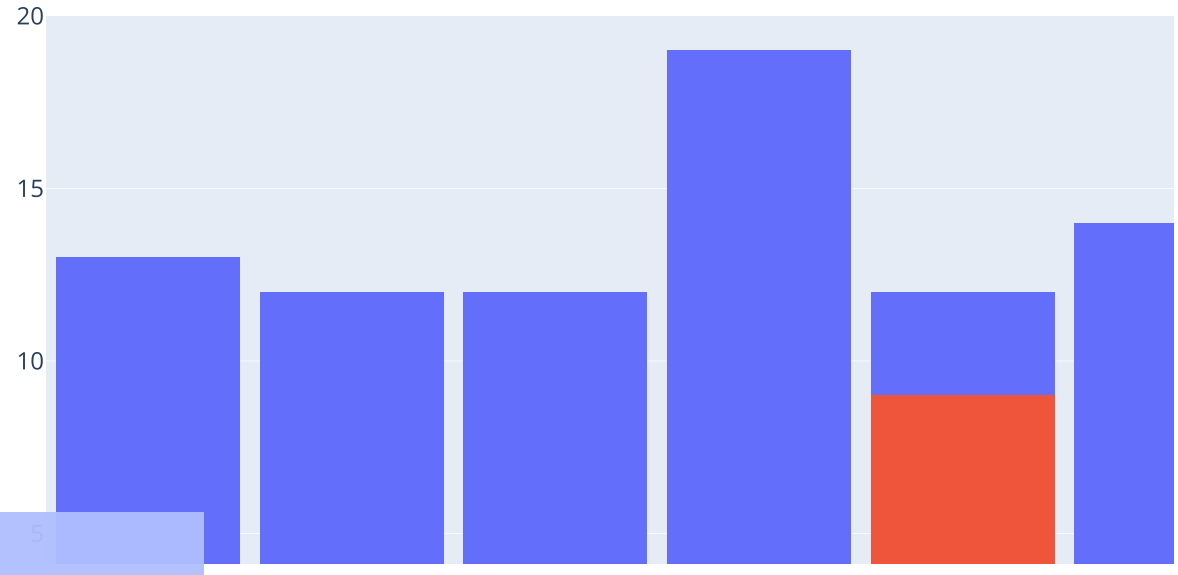

Sort Histogram by Category Order

Histogram bars can also be sorted based on the ordering logic of the categorical values using the categoryorder (https://plotly.com/python/reference/layout/xaxis/#layout-xaxis-categoryorder) attribute of the x-axis. Sorting of histogram bars using categoryorder also works with multiple traces on the same x-axis. In the following examples, the histogram bars are sorted based on the total numerical values.

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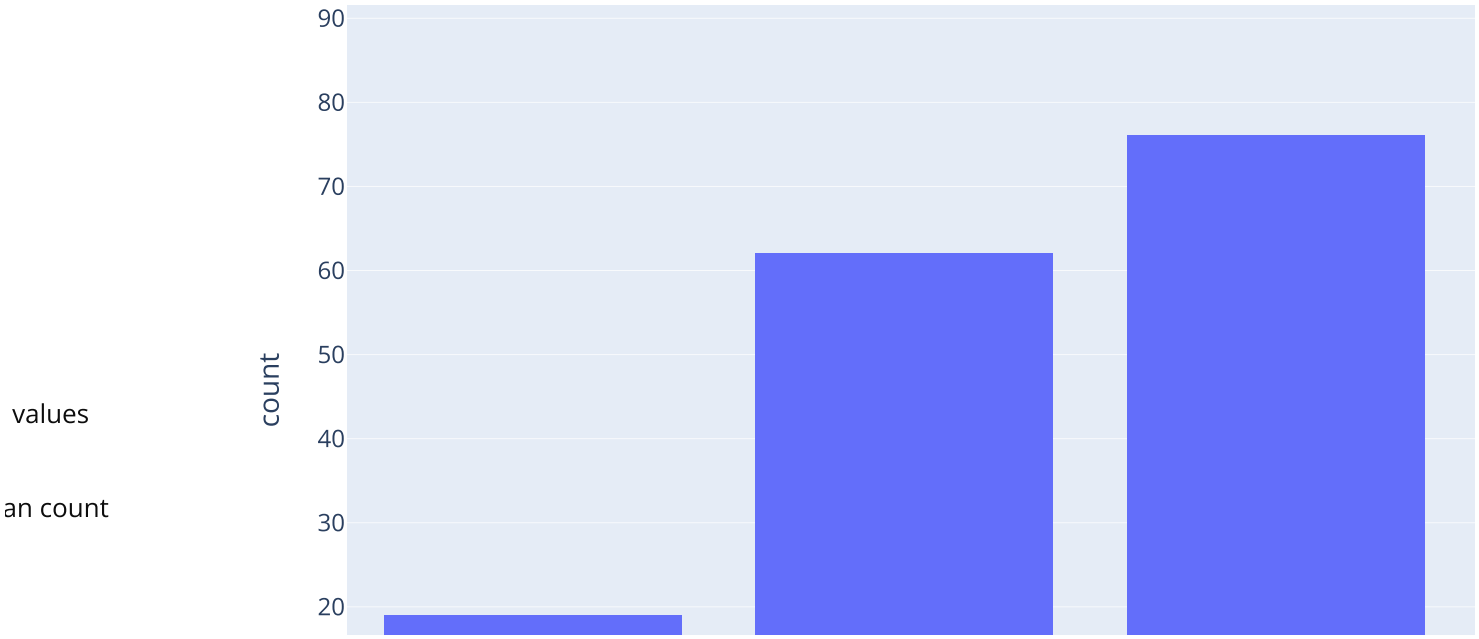
```
import plotly.express as px

df = px.data.tips()
fig = px.histogram(df, x="day").update_xaxes(categoryorder='total ascendin
g')
fig.show()
```



values

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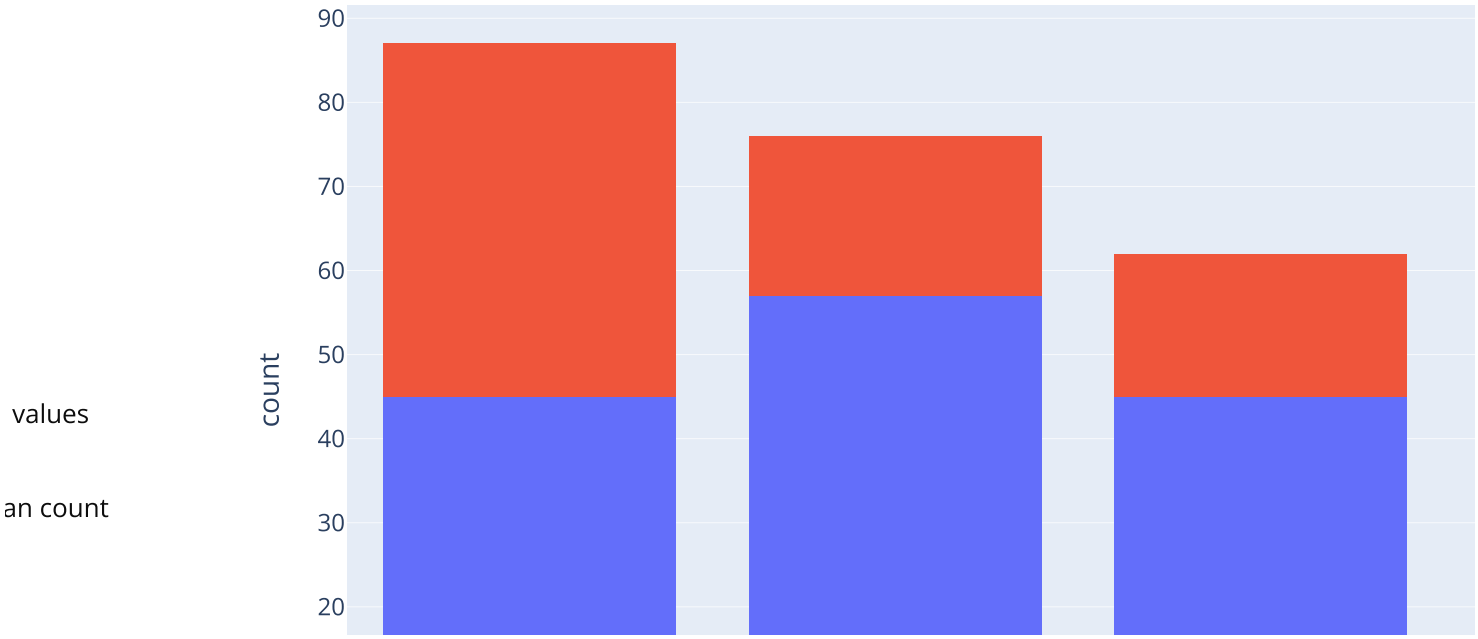
```
import plotly.express as px

df = px.data.tips()
fig = px.histogram(df, x="day", color="smoker").update_xaxes(categoryorder
='total descending')
fig.show()
```



Reference

See function reference for px.histogram() (https://plotly.com/python-api-reference/generated/plotly.express.histogram) or https://plotly.com/python/reference/histogram/ (https://plotly.com/python/reference/histogram/) for more information and chart attribute options!

What About Dash?

Dash (https://dash.plot.ly/) is an open-source framework for building analytical applications, with no Javascript required, and it is tightly integrated with the Plotly graphing library.

Learn about how to install Dash at https://dash.plot.ly/installation (https://dash.plot.ly/installation).

values

Everywhere in this page that you see fig.show(), you can display the same figure in a Dash application by passing it to the figure argument of the Graph component (https://dash.plot.ly/dash-core-components/graph) from the built-in dash_core_components package like this:

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```
import plotly.graph_objects as go # or plotly.express as px
fig = go.Figure() # or any Plotly Express function e.g. px.bar(...)
# fig.add_trace( ... )
# fig.update_layout( ... )

from dash import Dash, dcc, html
```


```
app = Dash()
app.layout = html.Div([
    dcc.Graph(figure=fig)
])

app.run_server(debug=True, use_reloader=False)  # Turn off reloader if insid
```