Linear and Non-Linear Trendlines in Python

Add linear Ordinary Least Squares (OLS) regression trendlines or non-linear Locally Weighted Scatterplot Smoothing (LOWESS) trendlines to scatterplots in Python. Options for moving averages (rolling means) as well as exponentially-weighted and expanding functions.

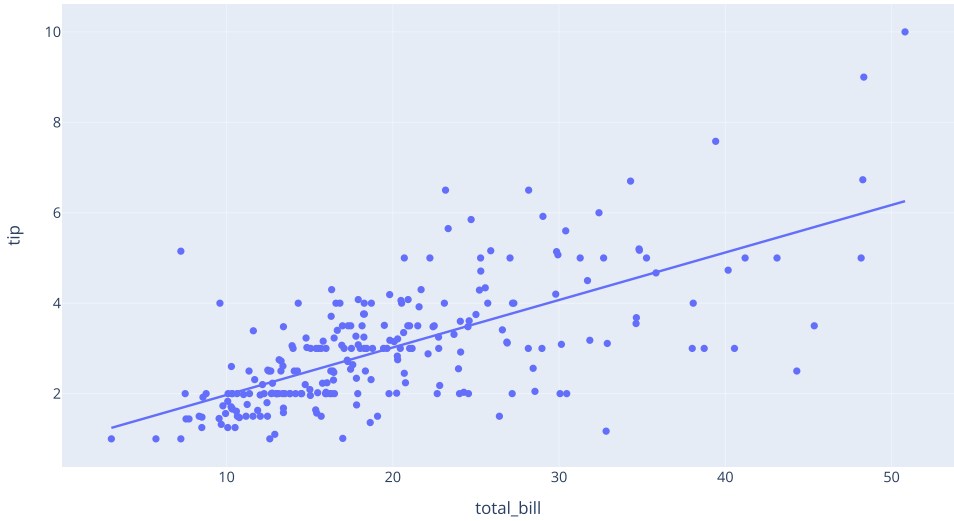
Linear fit trendlines with Plotly Express

Plotly Express (/python/plotly-express/) is the easy-to-use, high-level interface to Plotly, which operates on a variety of types of data (/python/px-arguments/) and produces easy-to-style figures (/python/styling-plotly-express/).

Plotly Express allows you to add Ordinary Least Squares (https://en.wikipedia.org/wiki/Ordinary_least_squares) regression trendline to scatterplots with the `trendline` argument. In order to do so, you will need to install statsmodels and its dependencies (https://www.statsmodels.org/stable/install.html). Hovering over the trendline will show the equation of the line and its R-squared value.

```
import plotly.express as px

df = px.data.tips()
fig = px.scatter(df, x="total_bill", y="tip", trendline="ols")
fig.show()
```



Fitting multiple lines and retrieving the model parameters

Plotly Express will add a trendline per trace, and allows you to access the underlying model parameters for all the models.

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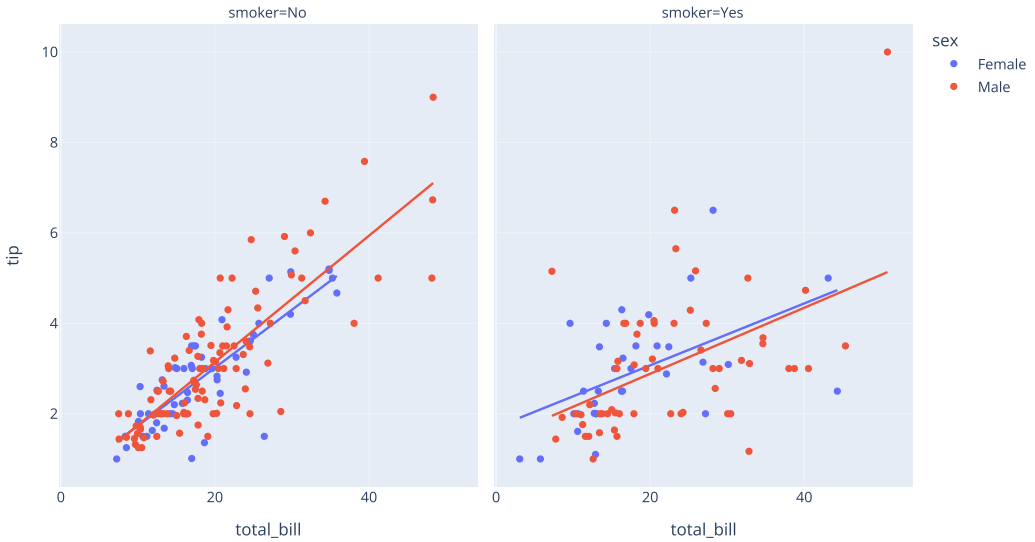
```
import plotly.express as px

df = px.data.tips()
fig = px.scatter(df, x="total_bill", y="tip", facet_col="smoker", color="sex", trendline="ols")
fig.show()

results = px.get_trendline_results(fig)
print(results)

results.query("sex == 'Male' and smoker == 'Yes'").px_fit_results.iloc[0].summary()
```




```
    sex smoker                px_fit_results
0  Female     No  <statsmodels.regression.linear_model.Regressio...
1  Female    Yes  <statsmodels.regression.linear_model.Regressio...
2    Male     No  <statsmodels.regression.linear_model.Regressio...
3    Male    Yes  <statsmodels.regression.linear_model.Regressio...
```

OLS Regression Results

Dep. Variable:	y	**R-squared:**	0.232
Model:	OLS	**Adj. R-squared:**	0.219
Method:	Least Squares	**F-statistic:**	17.56
Date:	Tue, 08 Jul 2025	**Prob (F-statistic):**	9.61e-05
Time:	20:26:57	**Log-Likelihood:**	-101.03
No. Observations:	60	**AIC:**	206.1
Df Residuals:	58	**BIC:**	210.2
Df Model:	1		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	1.4253	0.424	3.361	0.001	0.576	2.274
x1	0.0730	0.017	4.190	0.000	0.038	0.108

Omnibus:	21.841	**Durbin-Watson:**	1.383
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	33.031
Skew:	1.315	**Prob(JB):**	6.72e-08
Kurtosis:	5.510	**Cond. No.**	60.4

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Displaying a single trendline with multiple traces

Rather than fitting a single trendline using the entire dataset, set the trendline_scope argument to "overall". The same trendline will be overlaid on all facets and animation frames. The trendline color can be overridden with trendline_color_override.

```
import plotly.express as px

df = px.data.tips()
fig = px.scatter(df, x="total_bill", y="tip", symbol="smoker", color="sex", trendline="ols", trendline_scope="overall")
fig.show()
```

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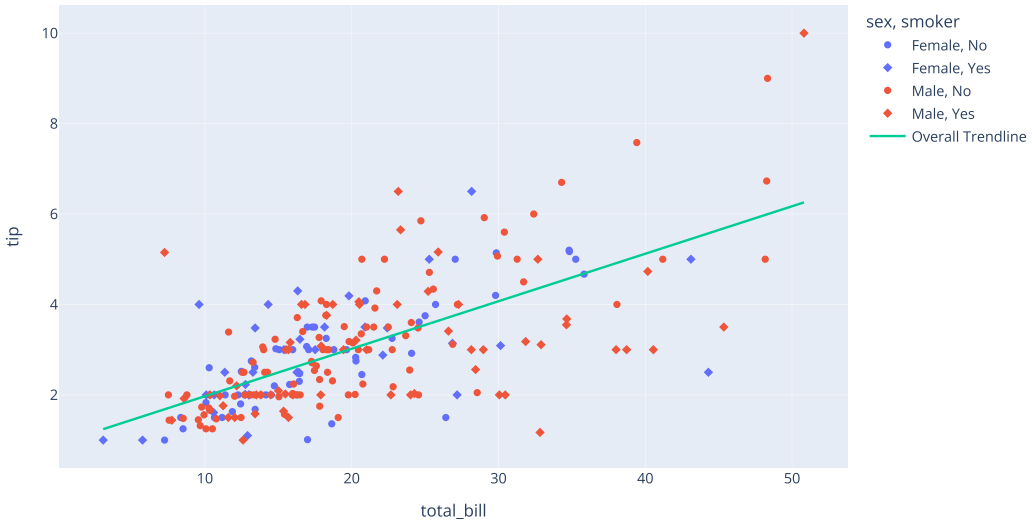
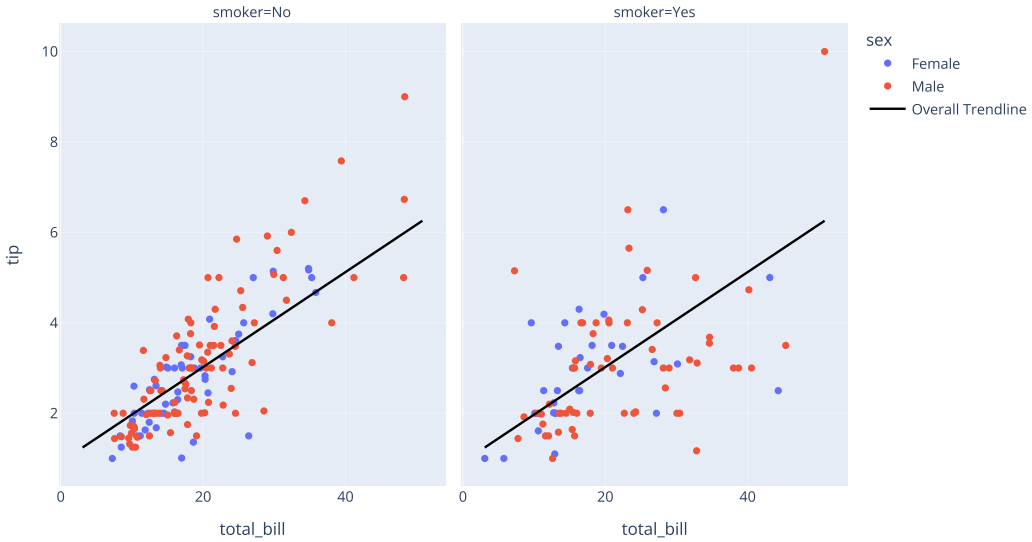



```
import plotly.express as px

df = px.data.tips()
fig = px.scatter(df, x="total_bill", y="tip", facet_col="smoker", color="sex",
                 trendline="ols", trendline_scope="overall", trendline_color_override="black")
fig.show()
```



OLS Parameters

with log transformations to both X or Y data using the `trendline_options` argument, independently of whether or not the plot has logarithmic

python/log-plot/).

```
import plotly.express as px

df = px.data.gapminder(year=2007)
fig = px.scatter(df, x="gdpPercap", y="lifeExp",
                 trendline="ols", trendline_options=dict(log_x=True),
                 title="Log-transformed fit on linear axes")
fig.show()
```

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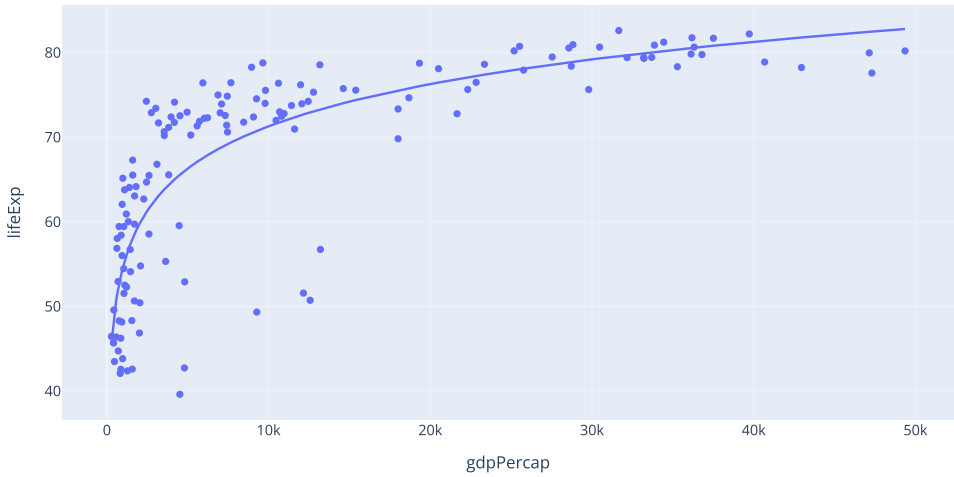
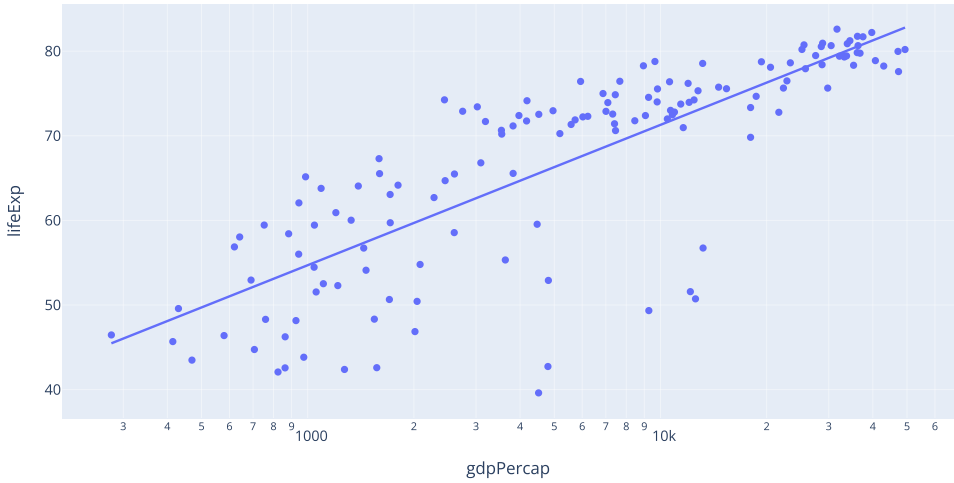
Log-transformed fit on linear axes




```
import plotly.express as px

df = px.data.gapminder(year=2007)
fig = px.scatter(df, x="gdpPercap", y="lifeExp", log_x=True,
                 trendline="ols", trendline_options=dict(log_x=True),
                 title="Log-scaled X axis and log-transformed fit")
fig.show()
```

Log-scaled X axis and log-transformed fit



ghted Scatterplot Smoothing (LOWESS)

Plo lise supports non-linear LOWESS (https://en.wikipedia.org/wiki/Local_regression) trendlines. In order use this feature, you will need to install mo ts dependencies (https://www.statsmodels.org/stable/install.html).

```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="lowess")
fig.show()
```

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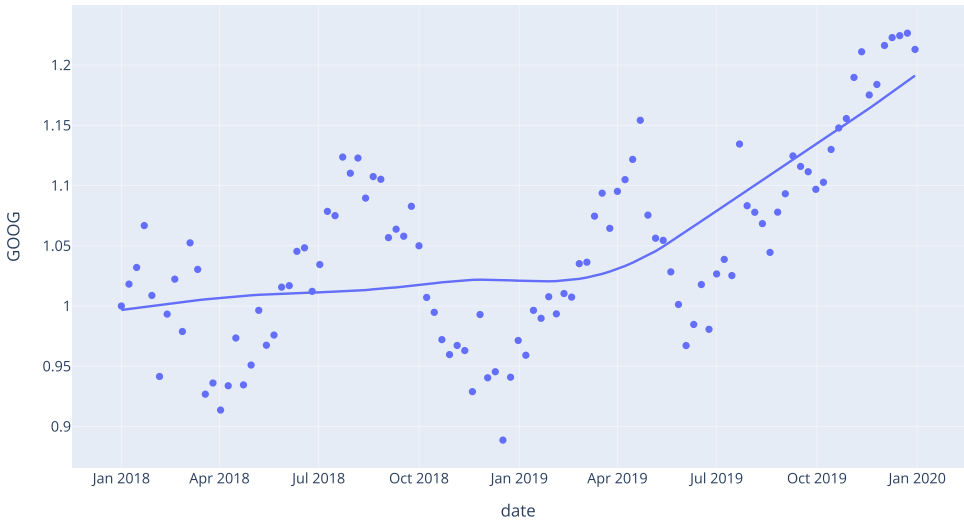
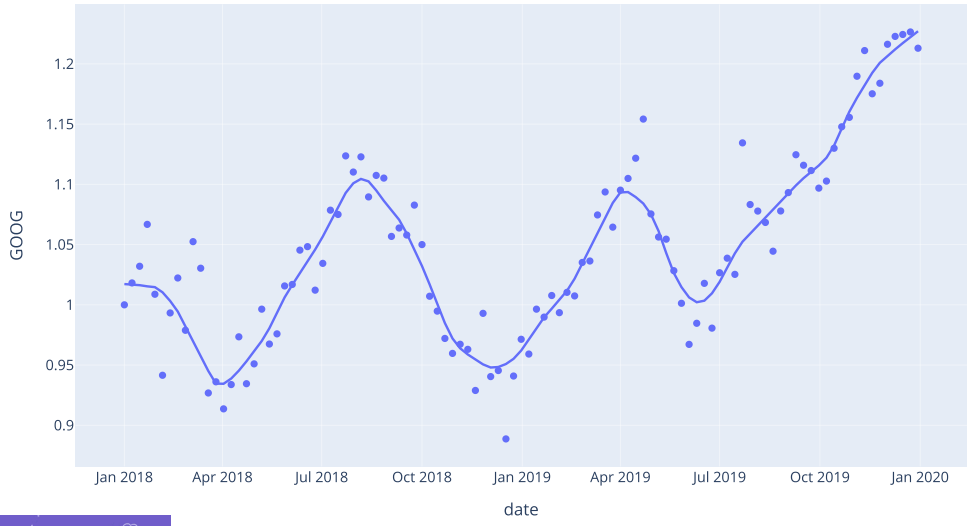


new in v5.2

The level of smoothing can be controlled via the `frac` trendline option, which indicates the fraction of the data that the LOWESS smoother should include. The default is a fairly smooth line with `frac=0.6666` and lowering this fraction will give a line that more closely follows the data.

```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="lowess", trendline_options=dict(frac=0.1))
fig.show()
```



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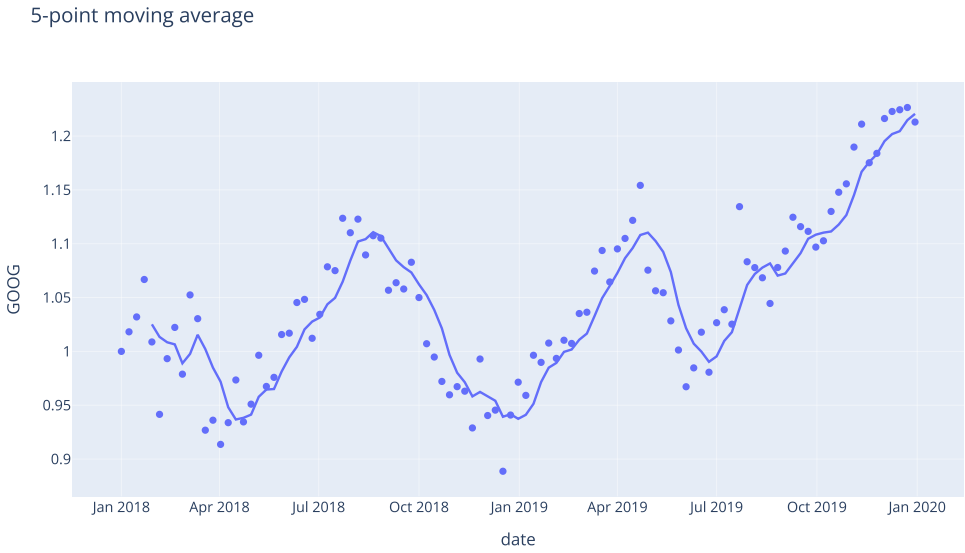
Moving Averages

new in v5.2

Plotly Express can leverage Pandas' rolling (https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.rolling.html), ewm (https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.ewm.html) and expanding (https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.expanding.html) functions in trendlines as well, for example to display moving averages. Values passed to trendline_options are passed directly to the underlying Pandas function (with the exception of the function and function_options keys, see below).

```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="rolling", trendline_options=dict(window=5),
                 title="5-point moving average")
fig.show()
```



```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="ewm", trendline_options=dict(halflife=2),
                 title="Exponentially-weighted moving average (halflife of 2 points)")
fig.show()
```

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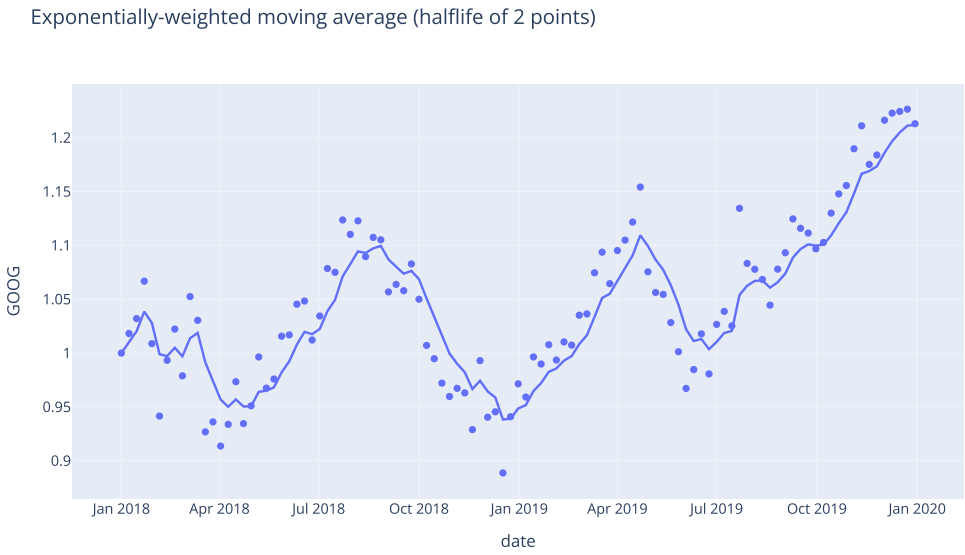
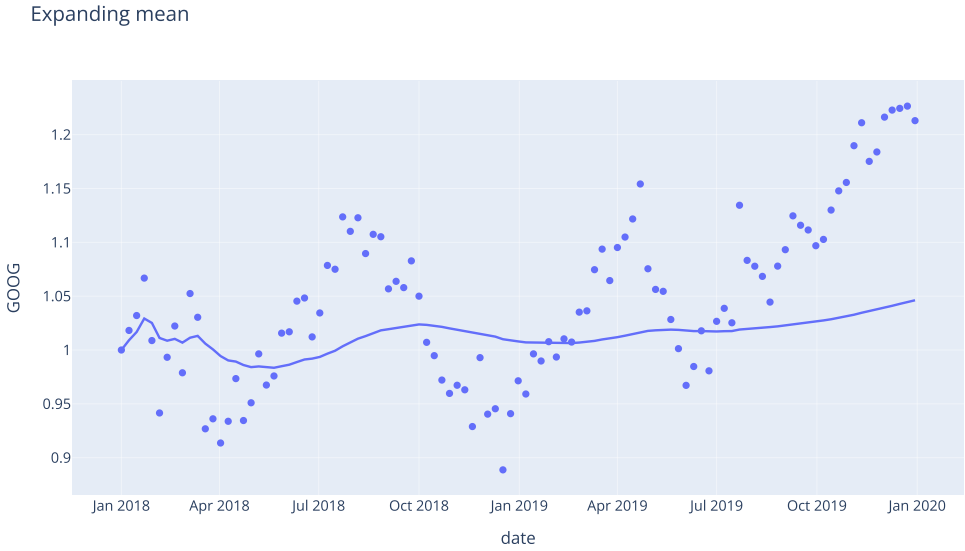



```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="expanding", title="Expanding mean")
fig.show()
```



Other Functions

ing and ewm trendlines support other functions than the default `mean`, enabling, for example, a moving-median trendline, or an expanding-max

```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="rolling", trendline_options=dict(function="median", window=5),
                title="Rolling Median")
fig.show()
```

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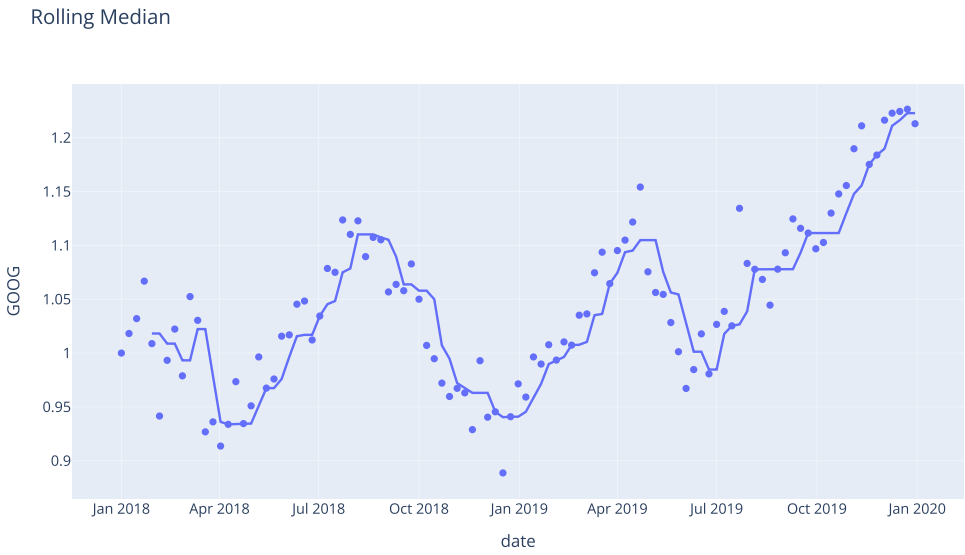
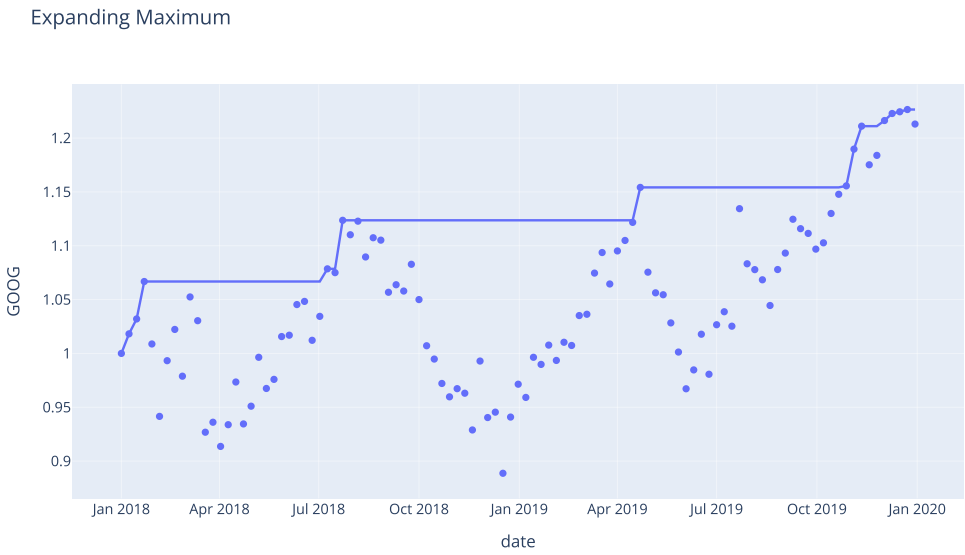



```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="expanding", trendline_options=dict(function="max"),
                title="Expanding Maximum")
fig.show()
```



In some cases, it is necessary to pass options into the underying Pandas function, for example the `std` parameter must be provided if the `win_type` argument to `rolling` is used. This is possible with the `function_args` trendline option.

```
import plotly.express as px

df = px.data.stocks(datetimes=True)
fig = px.scatter(df, x="date", y="GOOG", trendline="rolling",
                 trendline_options=dict(window=5, win_type="gaussian", function_args=dict(std=2)),
                title="Rolling Mean with Gaussian Window")
fig.show()
```

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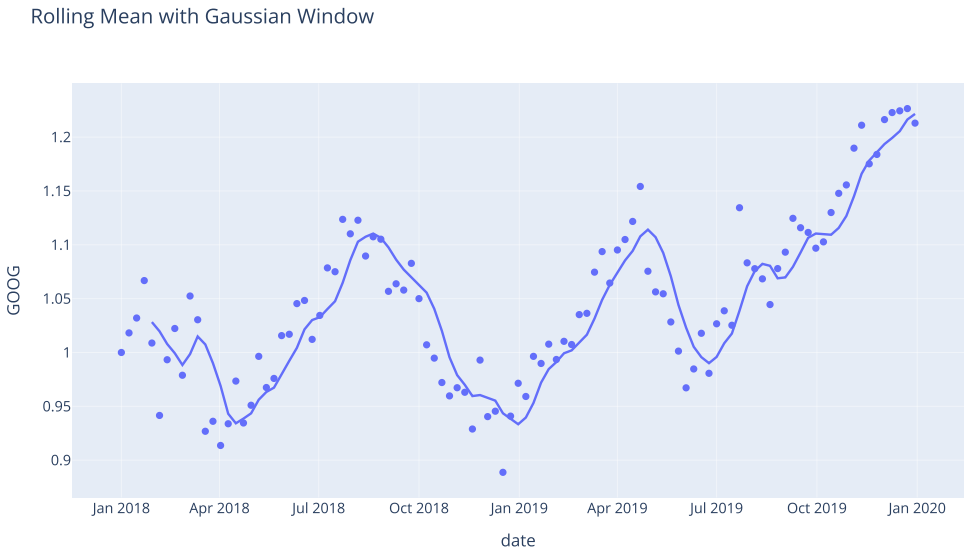
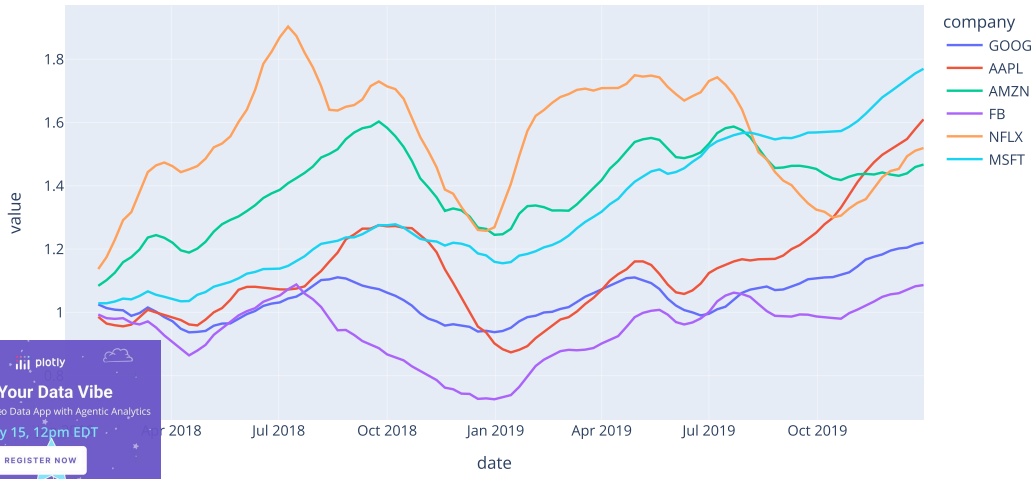


Displaying only the trendlines

In some cases, it may be desirable to show only the trendlines, by removing the scatter points.

```
import plotly.express as px

df = px.data.stocks(indexed=True, datetimes=True)
fig = px.scatter(df, trendline="rolling", trendline_options=dict(window=5),
                title="5-point moving average")
fig.data = [t for t in fig.data if t.mode == "lines"]
fig.update_traces(showlegend=True) #trendlines have showlegend=False by default
fig.show()
```



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).

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:

```
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(debug=True, use_reloader=False)  # Turn off reloader if inside Jupyter
```