Lesson 18: Seaborn Statistical Plots

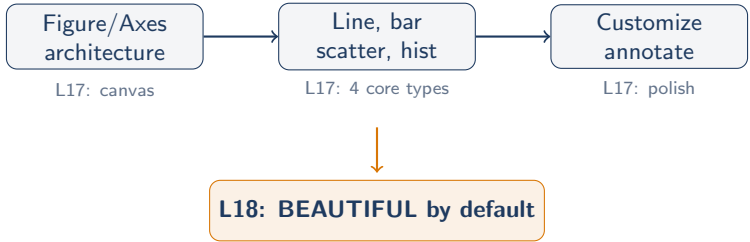
Data Science with Python – BSc Course

Data Science Program

BSc Course

45 Minutes

Previously on Data Science...



L17 taught you: how to build any chart from scratch. **L18 asks:** "What if charts came with *statistical intelligence* built in?"

Seaborn builds on matplotlib – everything you learned in L17 still applies

Learning Objectives

After this lesson, you will be able to:

1. Explain when to use seaborn vs raw matplotlib
2. Create distribution plots (histogram, KDE, violin, box)
3. Build regression plots with automatic confidence bands
4. Create and interpret correlation heatmaps
5. Apply seaborn themes to financial visualizations

Seaborn = matplotlib + statistical smarts + beautiful defaults

Matplotlib Is Powerful but Ugly by Default

Matplotlib gives you total control. Seaborn gives you good taste.

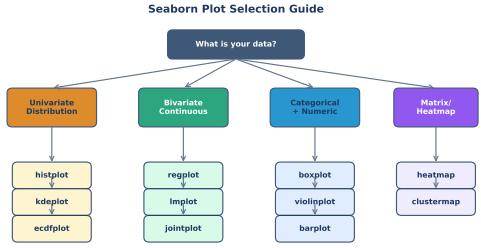
Think of it as Instagram filters for data:

- Same photo (data), but presented *better* with less effort
- Seaborn adds **statistical intelligence**: KDE, CI bands, regression
- Works directly with DataFrames – no manual data wrangling

When to use which:
Seaborn for statistical plots. Matplotlib for full customization.
In practice: use both together.

Seaborn is built on matplotlib – use sns for the chart, plt for fine-tuning

Seaborn Plot Types: The Map

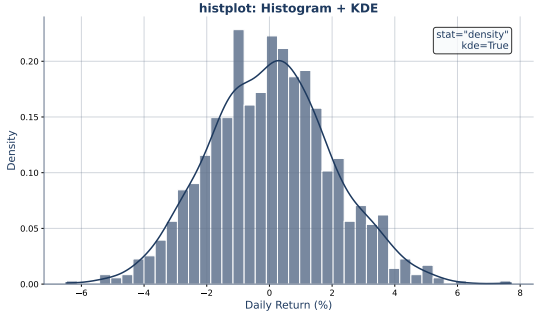


Choose based on: data type, variables, and question to answer

- **Distribution**: histplot, kdeplot, boxplot, violinplot
- **Relational**: scatterplot, lineplot, regplot
- **Matrix**: heatmap, clustermap

Know the map before you pick the plot

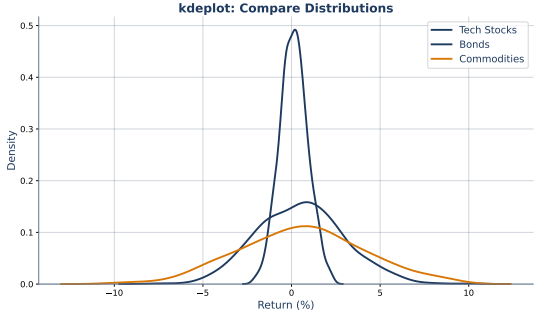
Histogram + KDE: Distribution at a Glance




```
sns.histplot(data, kde=True, stat='density')
```

One line of code gives you histogram + smooth density curve

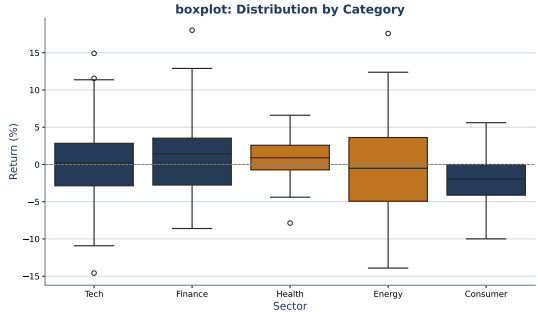
KDE: Comparing Distributions




```
sns.kdeplot(data=df, x='returns', hue='asset')
```

KDE smooths the histogram – easier to compare multiple groups

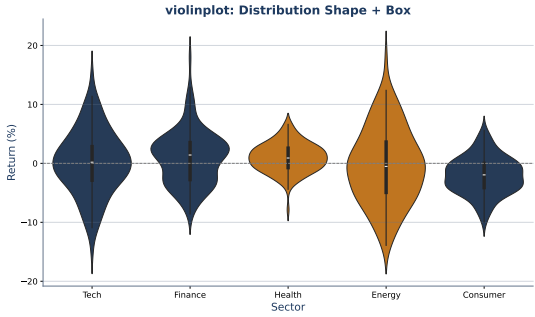
Boxplot: The Five-Number Summary



- Box: Q1 to Q3 (middle 50%)
- Line inside: median
- Whiskers: 1.5×IQR; dots beyond: outliers

Boxplots compress an entire distribution into one compact shape

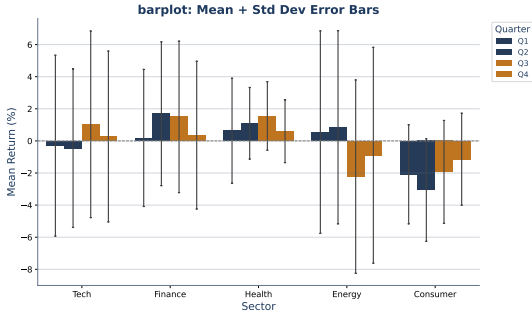
Violin Plot: Boxplot + KDE



Shows the *shape* of the distribution, not just summary statistics.

Use violin when the distribution shape matters – bimodal, skewed, or heavy-tailed

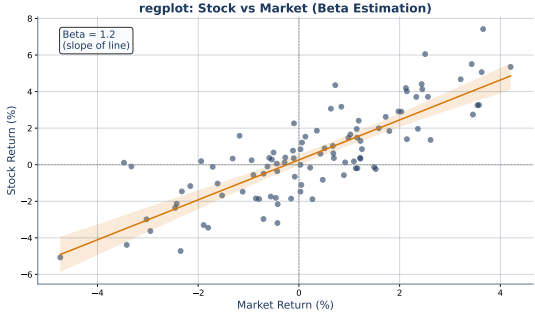
Bar Plot with Confidence Intervals



`sns.barplot(data=df, x='sector', y='return', ci=95)`
Seaborn automatically computes mean and confidence interval.

Error bars tell you whether differences are real or just noise

Regplot: Scatter + Regression in One



`sns.regplot(data=df, x='risk', y='return')`
Fits OLS line with 95% confidence band automatically.

The shaded band shows uncertainty – wider means less confident

Checkpoint: Boxplot or Violin?

Quick Check

When does a violin plot beat a boxplot?

A) When you have few categories

B) When the distribution might be bimodal

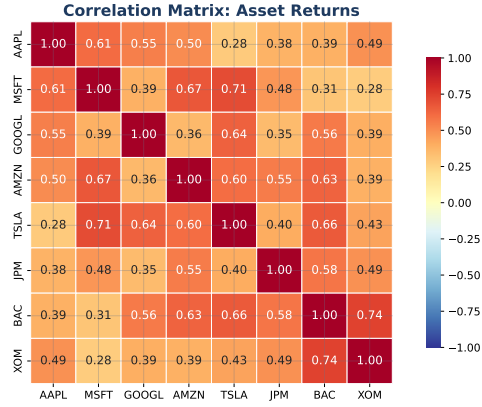
C) When you need exact quartile values

D) When your data is normally distributed

Answer: B – violins reveal shape; boxplots hide bimodality

Boxplots summarize; violins reveal – choose based on what matters

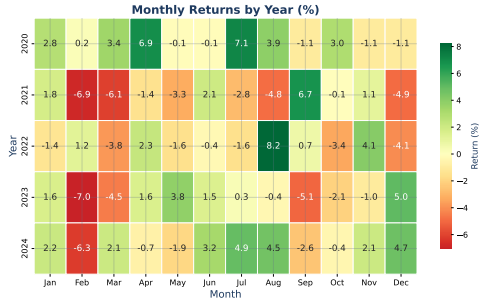
Heatmap: Correlation Matrix




```
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')
```

Heatmaps turn a matrix of numbers into a visual pattern you can scan in seconds

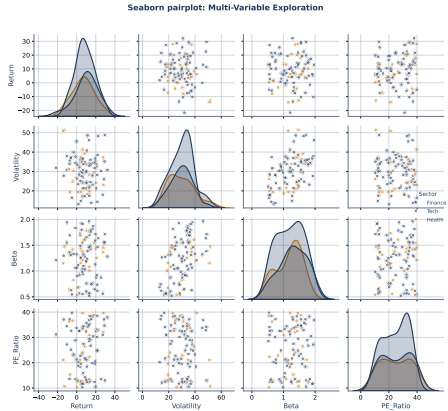
Heatmap: Monthly Returns Calendar



Pivot table + heatmap reveals seasonal patterns in returns.

Diverging colormaps make gains and losses instantly visible

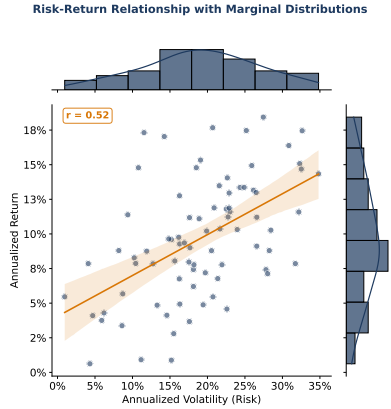
Pairplot: All Relationships at Once



`sns.pairplot(df, hue='category')` – one line, n^2 plots.

Pairplot is the fastest way to explore a new dataset

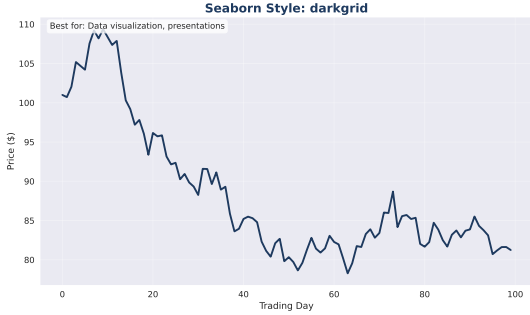
Jointplot: Marginal Distributions



Scatter + marginal histograms show relationship and distributions together.

Jointplot shows the bivariate relationship AND each variable's distribution

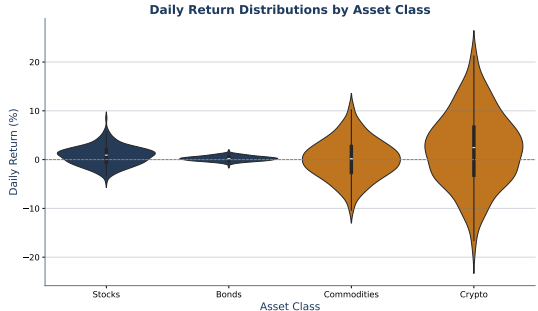
Themes: Change the Mood



`sns.set_style("darkgrid")` – or whitegrid, white, ticks.
`sns.set_context("talk")` – scale fonts for presentations.

Style sets the background; context sets the font scale

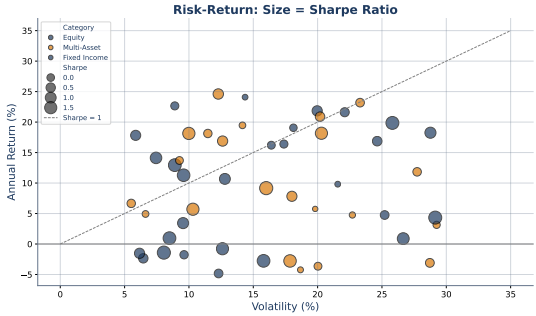
Finance: Asset Return Distributions



Compare return distributions across asset classes with one `kdeplot` call.

Fat tails in finance: real asset returns are not normally distributed

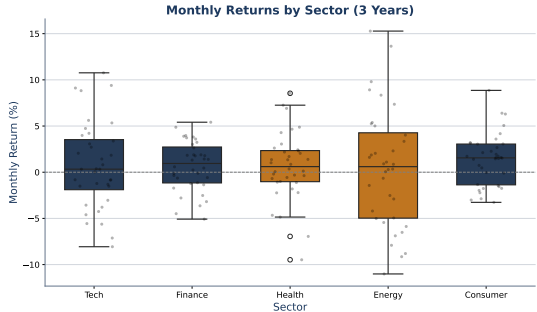
Finance: Risk-Return Scatter



`sns.regplot()` fits the risk-return relationship with confidence band.

Higher risk should mean higher return – regplot shows if the data agrees

Finance: Sector Return Comparison



One boxplot per sector reveals median, spread, and outliers.

Boxplots let portfolio managers compare sector risk profiles at a glance

Hands-On: Seaborn Financial Dashboard

Task: Recreate L17's dashboard with seaborn in half the code.

1. Create a DataFrame with daily returns for 3 assets
2. **Plot 1:** `sns.kdeplot()` comparing return distributions
3. **Plot 2:** `sns.boxplot()` comparing assets
4. **Plot 3:** `sns.heatmap()` of correlation matrix
5. **Plot 4:** `sns.regplot()` risk vs return

Compare: How many lines of code vs your L17 dashboard?

Hands-on: 10 minutes – seaborn should cut your code by 50%

Same Data, Better Story

"Seaborn doesn't replace matplotlib. It makes matplotlib dress up for the occasion."

Use seaborn for statistical charts, matplotlib for everything else – together they cover it all

Key Takeaways

What you now know:

1. **Seaborn vs matplotlib**: seaborn for statistics, matplotlib for full control
2. **Distribution plots**: histplot, kdeplot, boxplot, violinplot reveal data shape
3. **Regression plots**: regplot adds OLS line + confidence band automatically
4. **Heatmaps**: correlation matrices and time patterns in one glance
5. **Themes**: set_style() and set_context() for professional, presentation-ready output

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You now have two complementary tools – matplotlib for control, seaborn for speed

Coming Up: L19 – Multi-Panel Figures

One chart tells a fact. Multiple charts tell a story.

- Arrange subplots into coherent dashboards
- Shared axes, consistent styling, figure-level layout
- Professional multi-panel figures for reports and papers

L19 teaches you to compose individual charts into publication-quality figures