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How to generate a colorful Matplotlib bar plot (20 columns) with labeled values on top for each  $(\beta, \gamma)$  pair from SEIR model.

Thought for 12s >

Analyzed ^

python

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```
# Colorful Matplotlib bar plot with labeled values for 20 ( $\beta, \gamma$ ) pairs from SEIR model
# - Uses matplotlib (no seaborn)
# - Single plot
# - Colorful via a categorical colormap (tab20)
# - Labels each bar with its numeric value
# - Example metric shown is basic reproduction number  $R_0 = \beta/\gamma$  (replace with desired metric)

import numpy as np
import matplotlib.pyplot as plt

def plot_seir_metric_bars(pairs, values, title="SEIR Metric by ( $\beta, \gamma$ )", ylabel="Metric Value", **kwargs):
    """
    Create a colorful bar plot (20 columns) with value labels above each bar.

    Parameters
    -----
    pairs : list[tuple[float, float]]
        List of (beta, gamma) tuples. Expected length: 20.
    values : list[float] or np.ndarray
        Metric values corresponding to each (beta, gamma).
    title : str
        Title for the chart.
    ylabel : str
        Y-axis label.
    ...
    pairs = list(pairs)
    values = np.asarray(values, dtype=float)
```

```
n = len(pairs)
if n != len(values):
    raise ValueError("pairs and values must be the same length")
if n != 20:
    # Not strictly required, but the user asked for 20 columns, so we
    print(f"Warning: You provided {n} pairs; the example expects 20. P

# X-axis labels: compact ( $\beta$ ,  $\gamma$ ) text
labels = [fr"{{beta:.2g}, {gamma:.2g}}" for beta, gamma in pairs]

# Colors: use a categorical palette with many distinct hues
cmap = plt.cm.tab20 # 20 distinct colors
colors = [cmap(i % 20) for i in range(n)]

fig, ax = plt.subplots(figsize=(14, 5))
x = np.arange(n)
bars = ax.bar(x, values, color=colors, edgecolor="black", linewidth=0.

# Value labels on top
ax.bar_label(bars, labels=[f"{v:.2f}" for v in values], padding=3, fontweight="bold")

# Aesthetics
ax.set_title(title)
ax.set_ylabel(ylabel)
ax.set_xticks(x)
ax.set_xticklabels(labels, rotation=45, ha="right")
ax.margins(x=0.01)
ax.grid(axis="y", linestyle="--", linewidth=0.5, alpha=0.6)
fig.tight_layout()
plt.show()

# -----
# Example usage
# -----
# Construct 20 ( $\beta$ ,  $\gamma$ ) pairs (replace with your own)
betas = np.linspace(0.15, 0.9, 5)      # example  $\beta$  values
gammas = np.linspace(0.1, 0.5, 4)       # example  $\gamma$  values
grid = [(b, g) for b in betas for g in gammas]
pairs20 = grid[:20] # ensure 20 pairs
```

```
# Example metric from SEIR results: use  $R_0 = \beta / \gamma$  as a stand-in
values20 = np.array([b / g for b, g in pairs20], dtype=float)

# Plot
plot_seir_metric_bars(
    pairs20,
    values20,
    title="R₀ by ( $\beta$ ,  $\gamma$ ) pairs (example)",
    ylabel="R₀ ( $\beta/\gamma$ )"
)
```

Here's a ready-to-use Matplotlib snippet that makes a colorful 20-bar chart with value labels on top for each  $(\beta, \gamma)$  pair. Replace `pairs20` and `values20` with your own SEIR results (e.g., peak I, final size, MSE vs. data, etc.). I also included an example using  $R_0 = \beta/\gamma$ .

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```
import numpy as np
import matplotlib.pyplot as plt

def plot_seir_metric_bars(pairs, values, title="SEIR Metric by ( $\beta$ ,  $\gamma$ )", yl
    """
    Colorful bar plot with value labels for  $(\beta, \gamma)$  pairs.
    pairs: list of (beta, gamma) tuples (ideally 20)
    values: metric per pair (same length)
    """
    pairs = list(pairs)
    values = np.asarray(values, float)
    n = len(pairs)

    labels = [fr"{{b:.2g}}, {{g:.2g}})" for b, g in pairs]
    cmap = plt.cm.tab20
    colors = [cmap(i % 20) for i in range(n)]

    fig, ax = plt.subplots(figsize=(14, 5))
    x = np.arange(n)
    bars = ax.bar(x, values, color=colors, edgecolor="black", linewidth=0.
```

```
# numeric labels on top
ax.bar_label(bars, labels=[f"{v:.2f}" for v in values], padding=3, fontweight="bold")

ax.set_title(title)
ax.set_ylabel(ylabel)
ax.set_xticks(x)
ax.set_xticklabels(labels, rotation=45, ha="right")
ax.grid(axis="y", linestyle="--", linewidth=0.5, alpha=0.6)
fig.tight_layout()
plt.show()

# ----- example (swap with your own data) -----
# 20 pairs:
betas = np.linspace(0.15, 0.90, 5)
gammas = np.linspace(0.10, 0.50, 4)
pairs20 = [(b, g) for b in betas for g in gammas][:20]

# e.g., use  $R_0 = \beta/\gamma$  as a stand-in metric (replace with your SEIR metric)
values20 = np.array([b/g for b, g in pairs20], float)

plot_seir_metric_bars(pairs20, values20, title="R0 by (\u03b2, \u03b3) pairs", ylab
```

Notes:

- To label with something else (e.g., "Peak I"), just feed those numbers into `values20`.
- If your Matplotlib version is old and lacks `bar_label`, you can loop over `bars` and use `ax.text(...)` to place labels manually. ↵

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