Programação II

Gráficos

Parte 2

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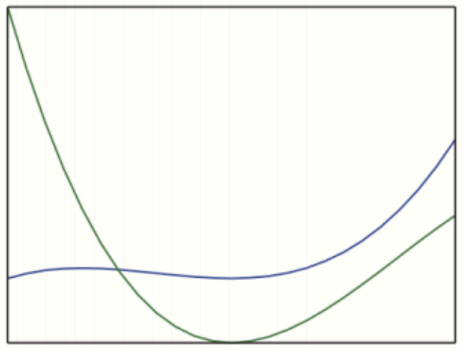
Gráficos

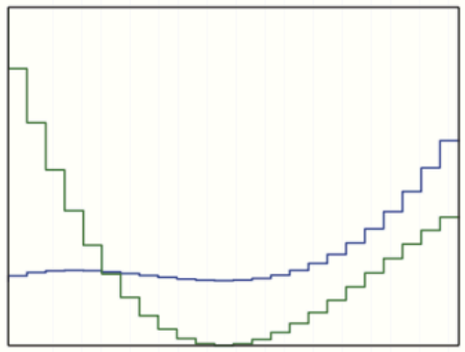
- Última aula
  - Introdução a gráficos no *matplotlib*
  - Tipos de gráficos *plot* e *imshow*
  - Customização de gráficos no *matplotlib*
- Esta aula:
  - Outros tipos de gráficos
  - Exemplos práticos

Tipos de gráficos

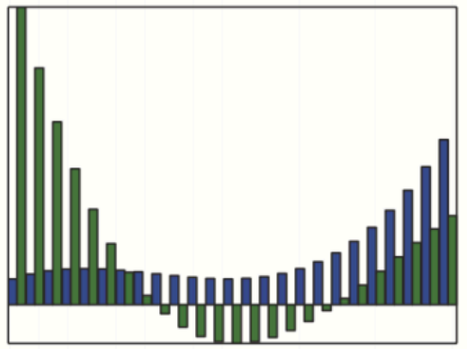
Axes.plot



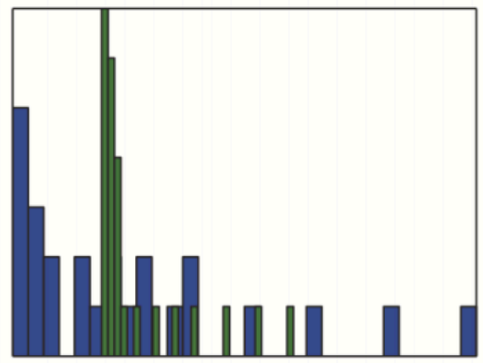
Axes.step



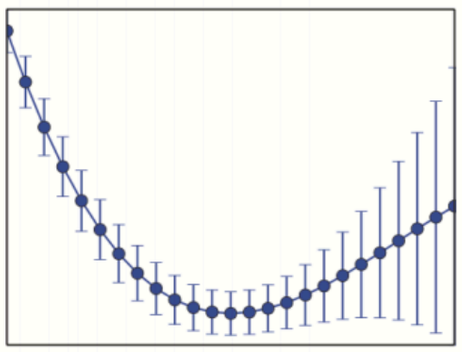
Axes.bar



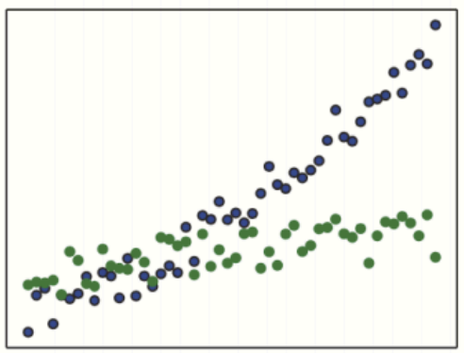
Axes.hist



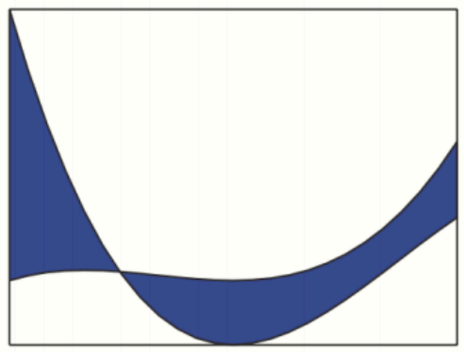
Axes.errorbar



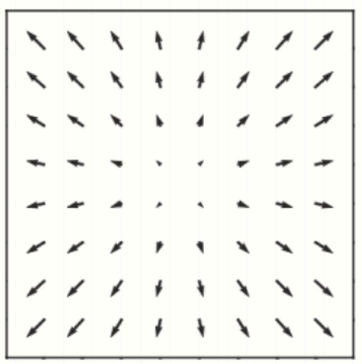
Axes.scatter



Axes.fill_between



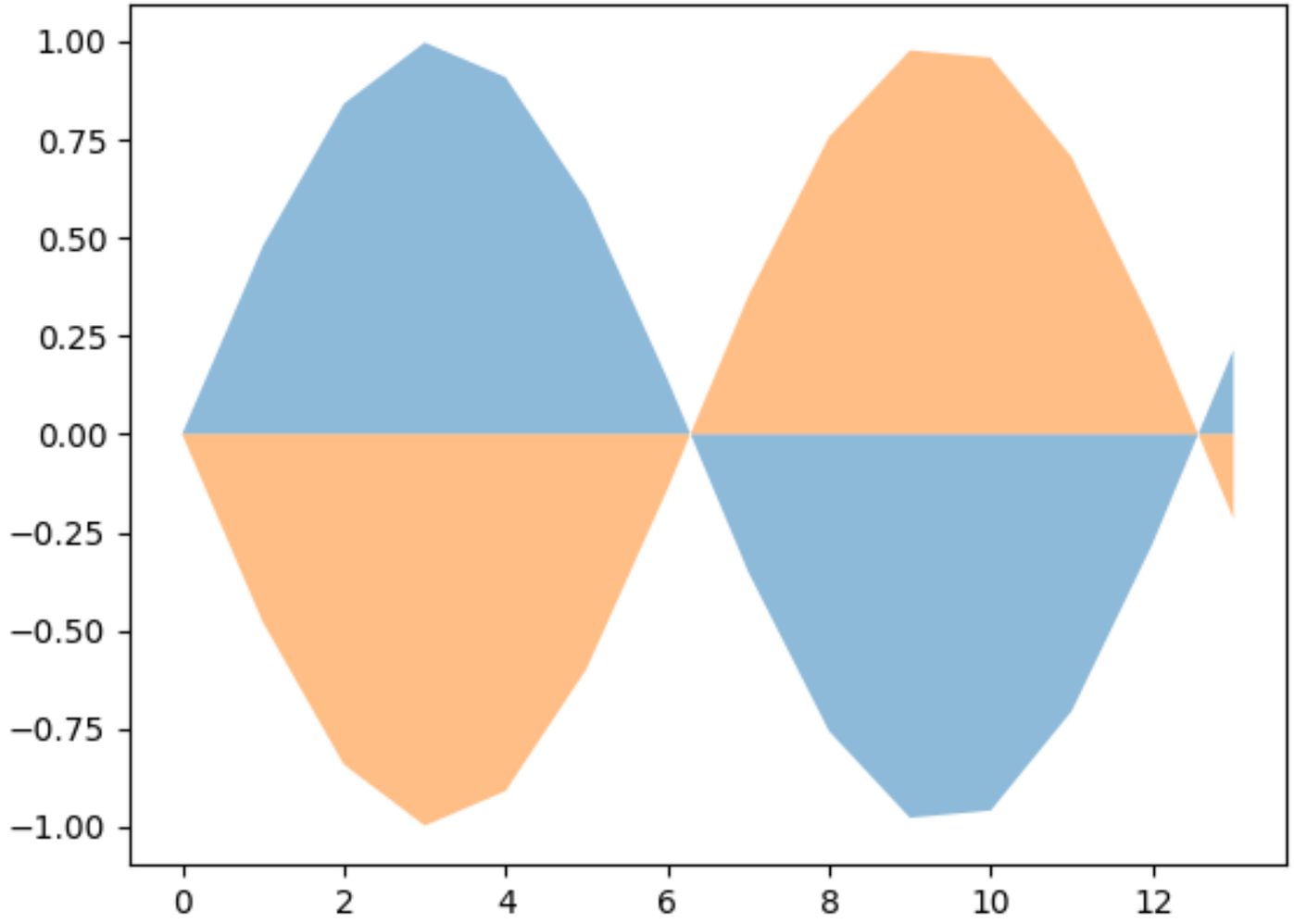
Axes.quiver



Matplotlib (fill)

```
x = np.arange(14)
y1 = np.sin(x / 2)
y2 = np.cos(math.pi/2 + x / 2)

plt.fill_between(x,y1,alpha=0.5)
plt.fill_between(x,y2,alpha=0.5)
plt.show()
```

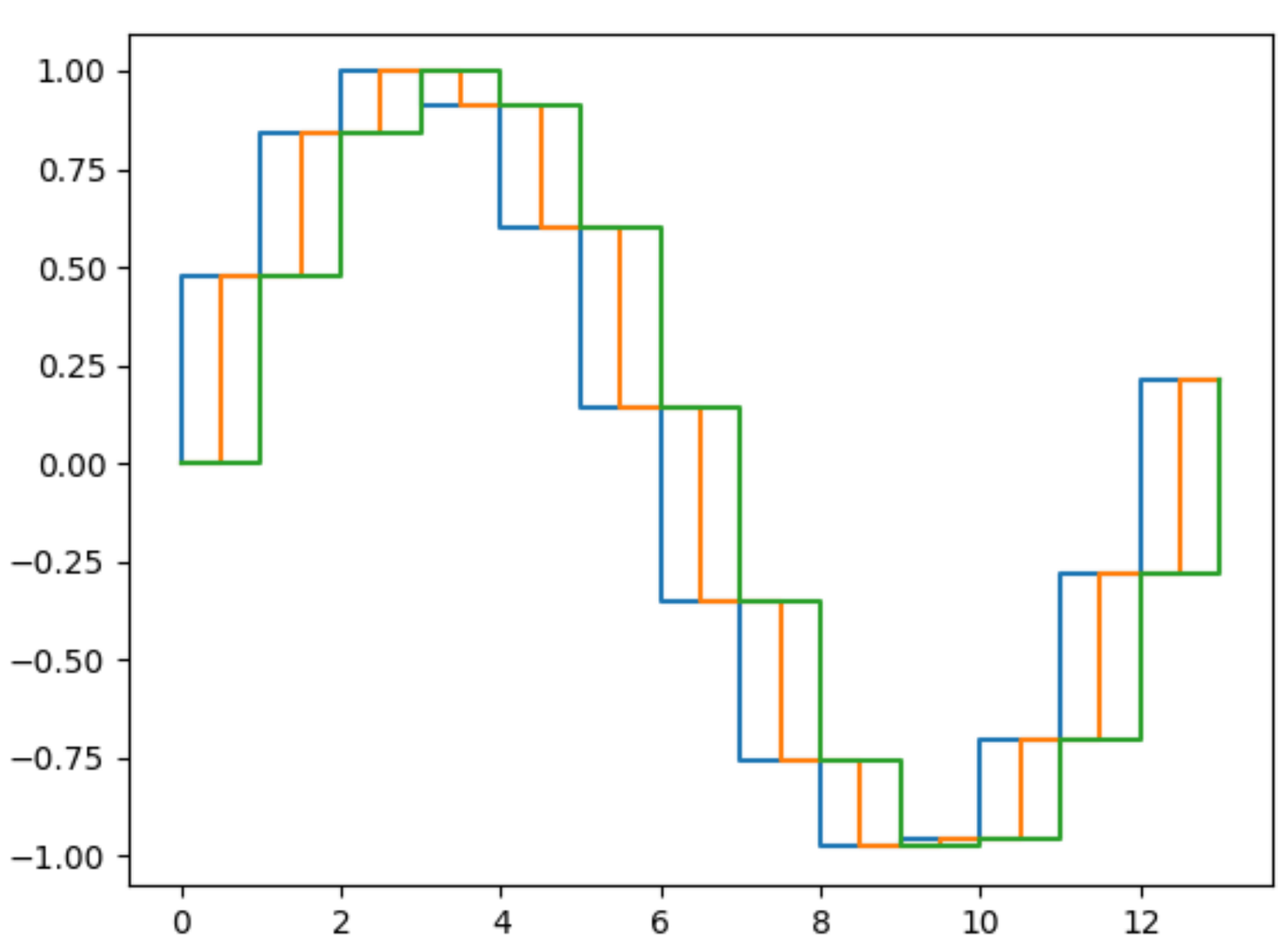
- Preencher a área entre o eixo dos X e cada curva



Matplotlib (step)

- Desenhar linhas retas em vez de curvas
- Podemos controlar a posição de cada ponto em relação ao nível

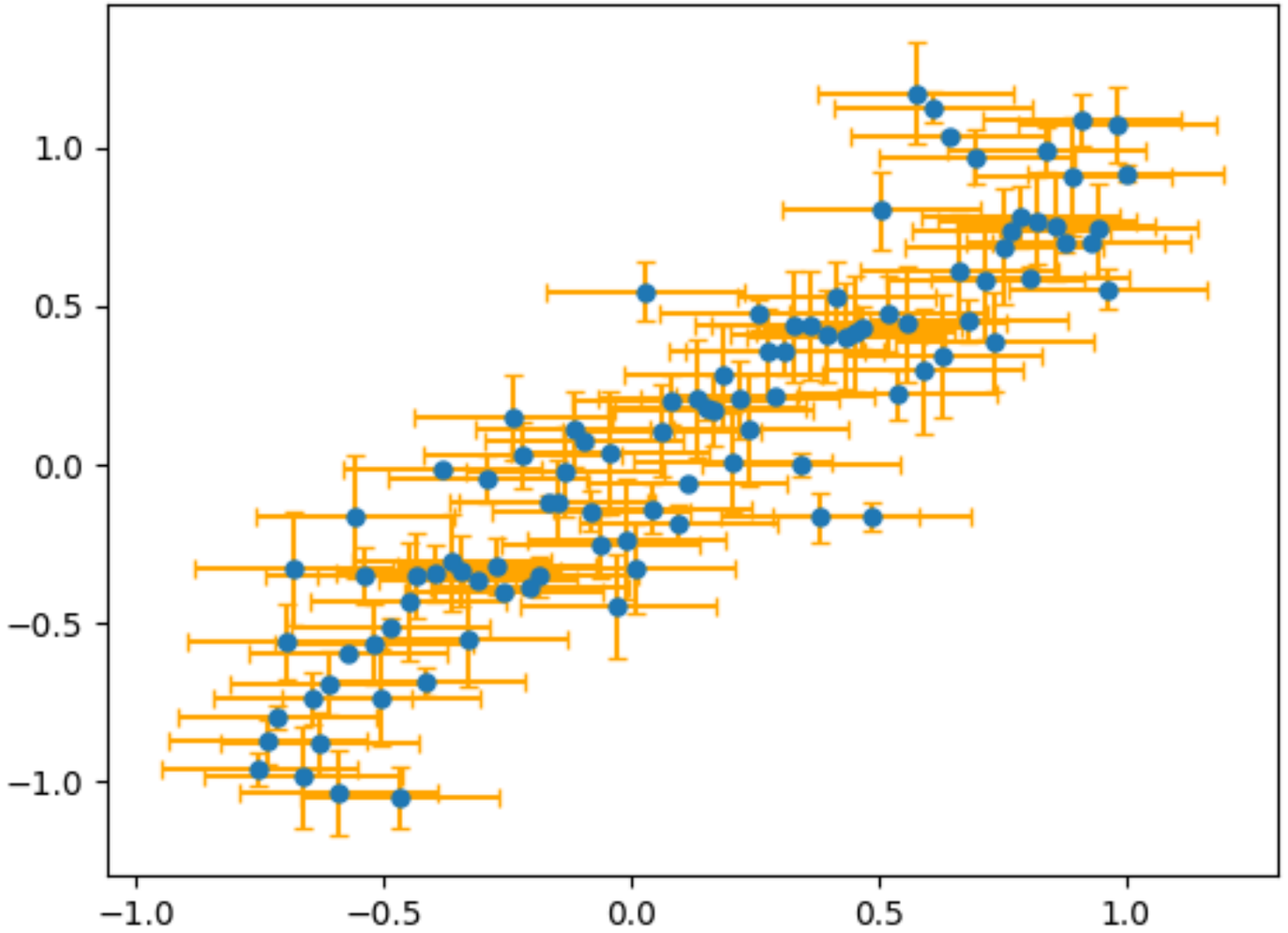
```
x = np.arange(14)
y = np.sin(x / 2)

plt.step(x, y)
plt.step(x, y , where='mid')
plt.step(x, y, where='post')
plt.show()
```



Matplotlib (errorbar)

- Atribuir uma margem de erro a cada dimensão
- Podemos controlar desenho dos intervalos

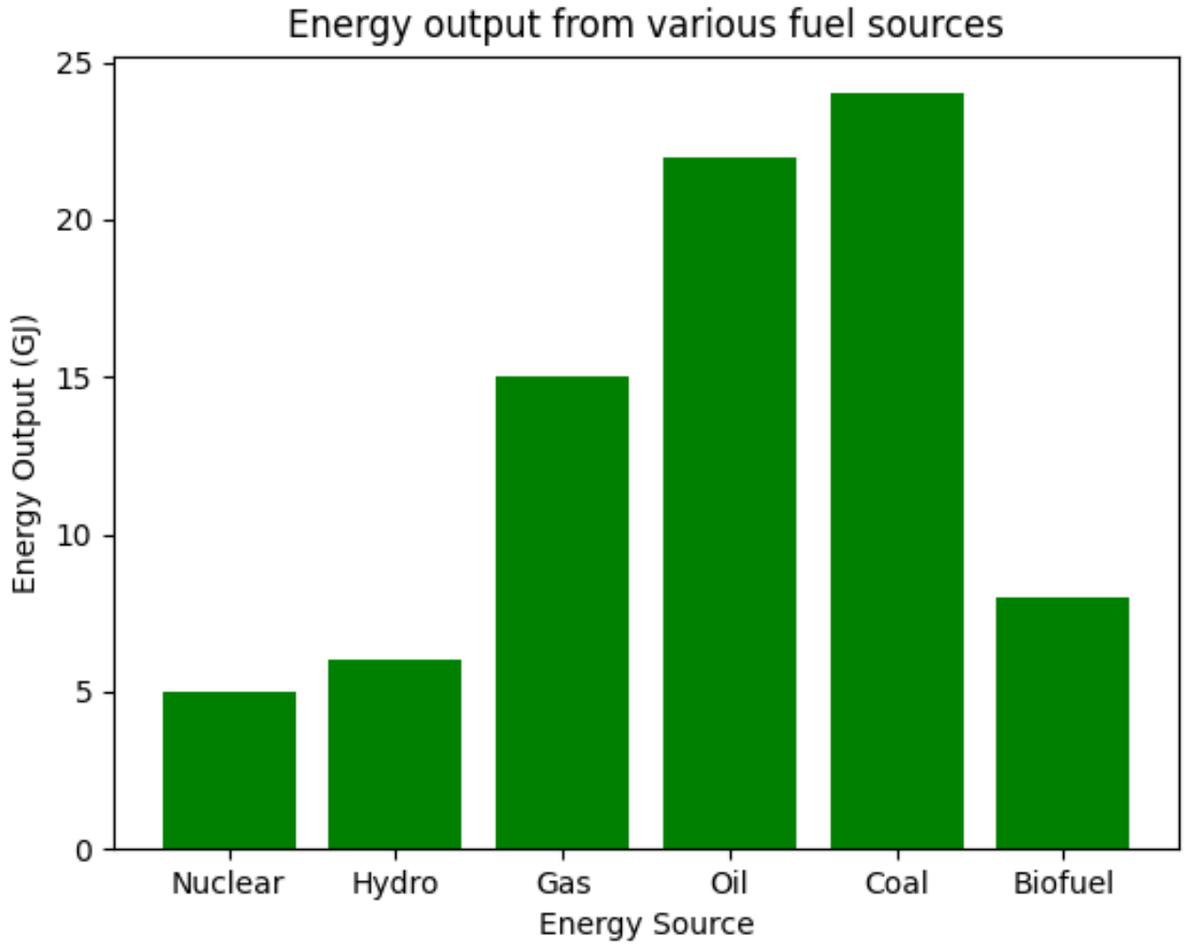
```
xx = np.linspace(-0.75, 1., 100)
yy = xx +
0.25*np.random.randn(len(xx))
sigma_y = np.random.uniform(0,0.2,
len(xx))
plt.errorbar(xx, yy, yerr=sigma_y,
xerr=0.2,fmt='o',markersize=5,
ecolor="orange", capsize=3)
plt.show()
```



Matplotlib (bar)

```
x = ['Nuclear', 'Hydro', 'Gas', 'Oil', 'Coal', 'Biofuel']
energy = [5, 6, 15, 22, 24, 8]
x_pos = [i for i, _ in enumerate(x)]

plt.bar(x_pos, energy, color='green')
plt.xlabel("Energy Source")
plt.ylabel("Energy Output (GJ)")
plt.title("Energy output from various fuel sources")
plt.xticks(x_pos,x)
plt.show()
```

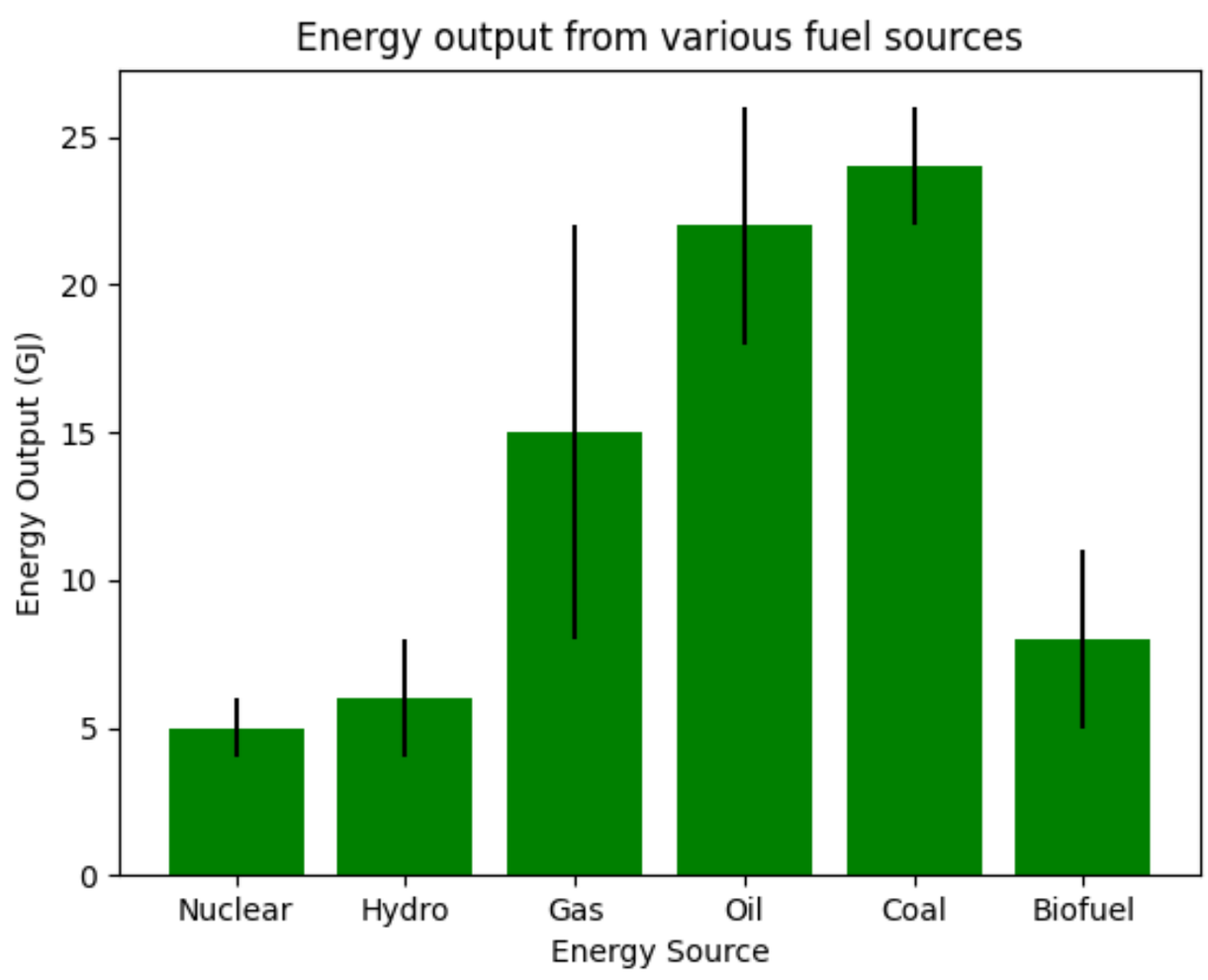
- Desenhar cada ponto como uma barra vertical



Matplotlib (bar)

```
x = ['Nuclear', 'Hydro', 'Gas', 'Oil', 'Coal', 'Biofuel']
energy = [5, 6, 15, 22, 24, 8]
variance = [1, 2, 7, 4, 2, 3]
x_pos = [i for i, _ in enumerate(x)]

plt.bar(x_pos, energy, color='green', yerr=variance)
plt.xlabel("Energy Source")
plt.ylabel("Energy Output (GJ)")
plt.title("Energy output from various fuel sources")
plt.xticks(x_pos, x)
plt.show()
```

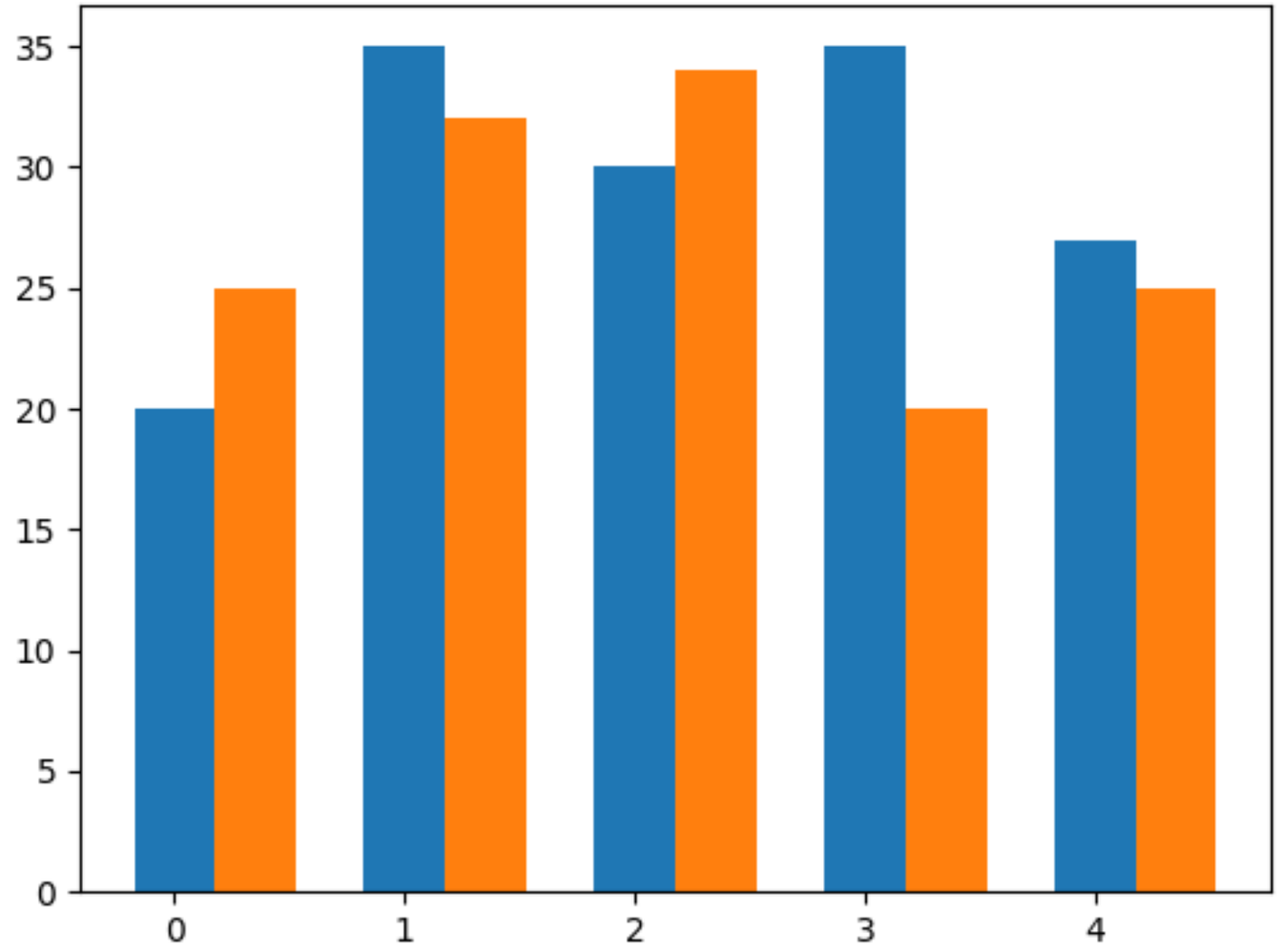
- Podemos acrescentar uma margem de erro



Matplotlib (bar)

```
xx = np.arange(5)
men_means = (20, 35, 30, 35, 27)
women_means = (25, 32, 34, 20, 25)

width=0.35
plt.bar(xx,men_means,width=width)
plt.bar(xx + width,women_means,width=width)
plt.show()
```

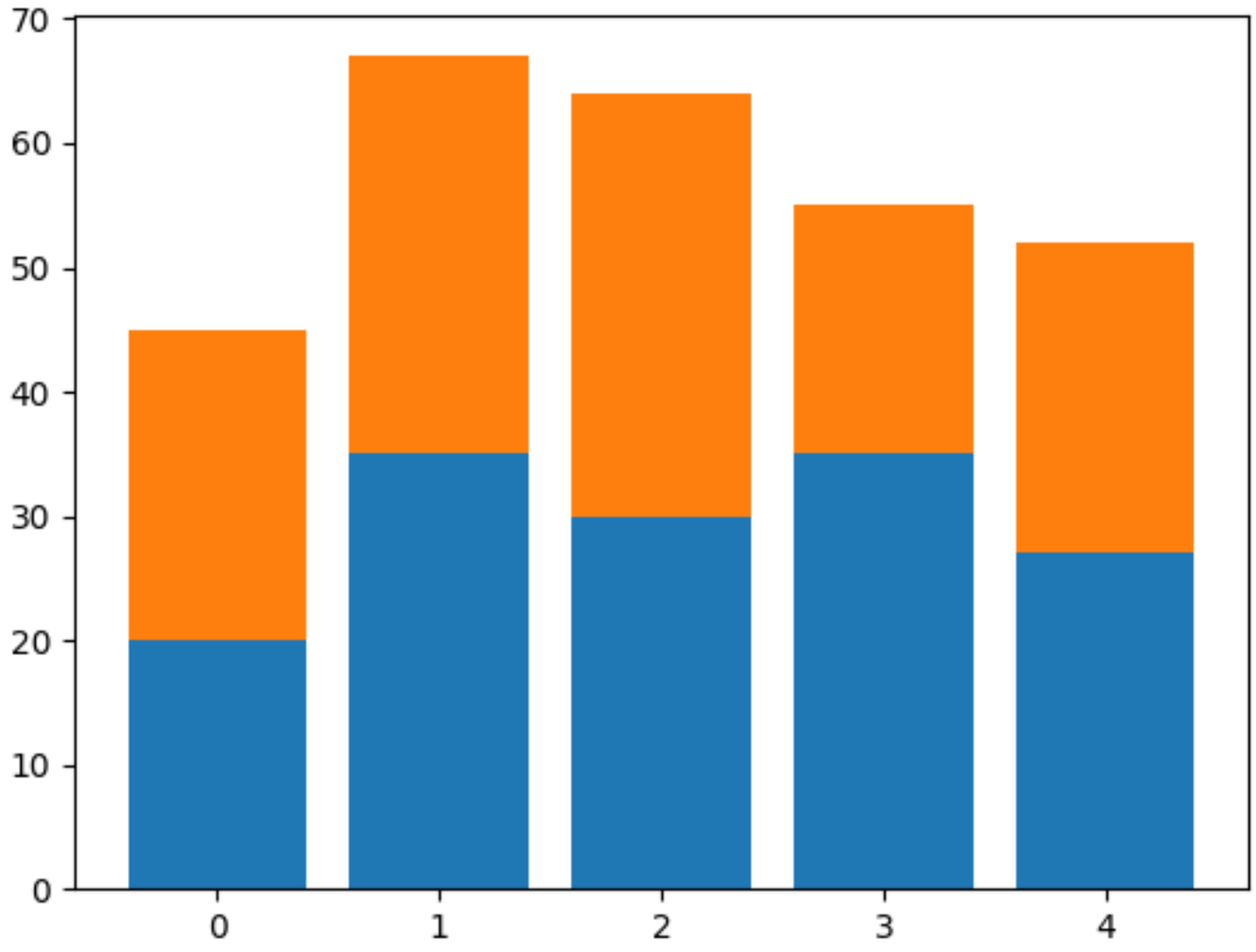
- Podemos desenhar múltiplas barras
  - Controlando a posição nos X



Matplotlib (bar)

```
xx = np.arange(5)
men_means = (20, 35, 30, 35, 27)
women_means = (25, 32, 34, 20, 25)

plt.bar(xx,men_means)
plt.bar(xx,women_means,bottom=men_means)
plt.show()
```

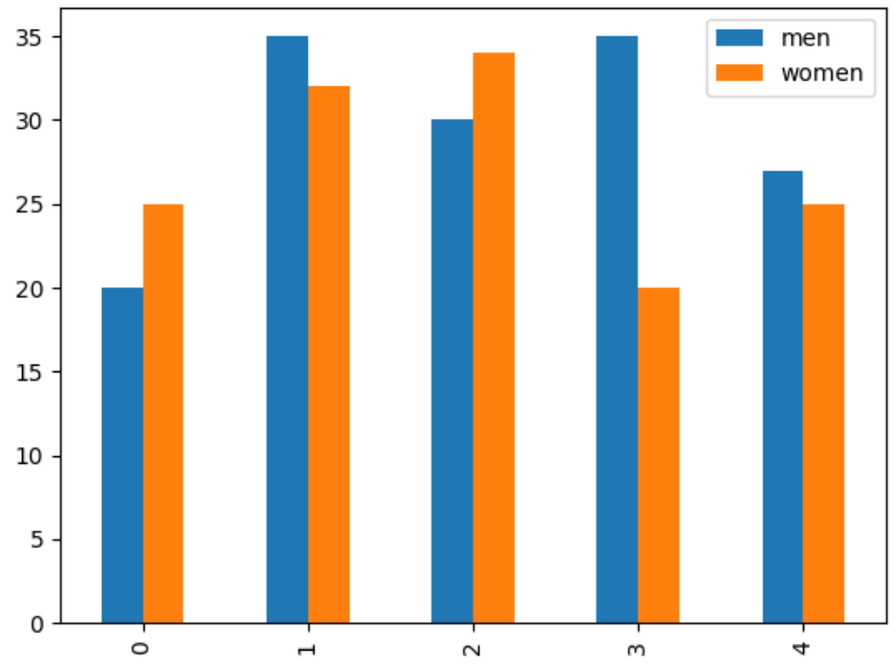
- Podemos desenhar múltiplas barras
    - Controlando a posição nos Y

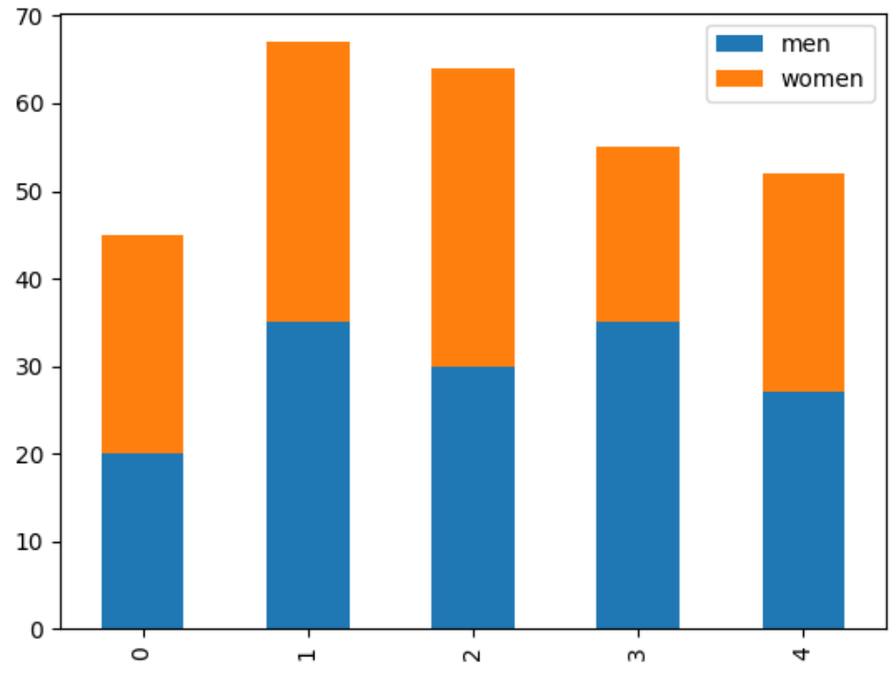


Matplotlib (bar)

- Desenhar múltiplas barras é mais simples utilizando um *DataFrame*

```
men_means = (20, 35, 30, 35, 27)
women_means = (25, 32, 34, 20, 25)
df =
pd.DataFrame({'men':men_means,'women
':women_means})

# lado a lado
df.plot(kind='bar')
plt.show()

# em cima uma da outra
df.plot(kind='bar',stacked=True)
plt.show()
```

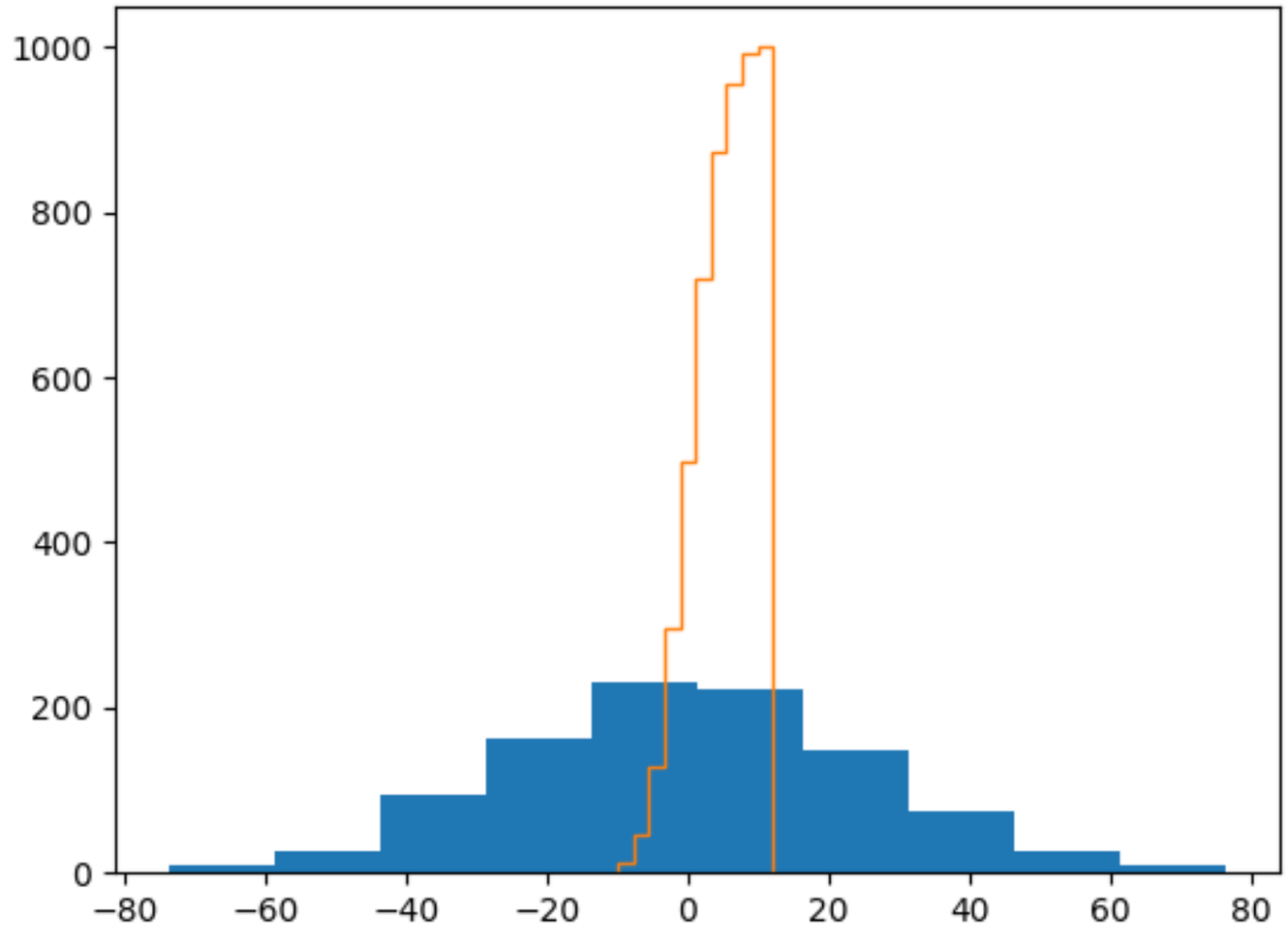




Matplotlib (hist)

- Desenhar um histograma a partir de uma sequência
  - X = valores na sequência
  - Y = número de ocorrências de cada valor

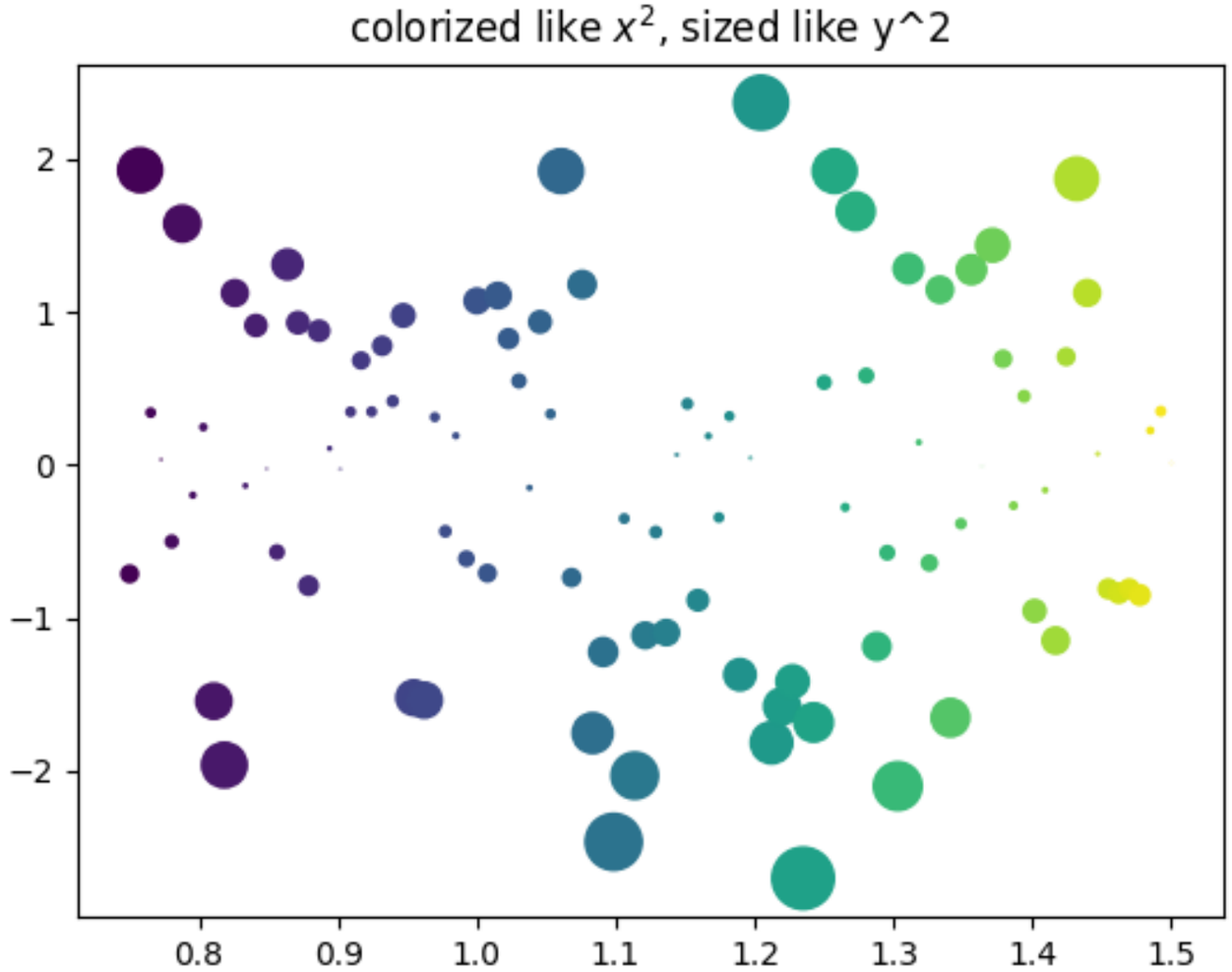
```
data1 = np.random.normal(1.,
25., 1000)
data2 = np.random.normal(1.,
4., 1000)
plt.hist(data1)
plt.hist(data2,histtype="step"
, cumulative=True)
plt.show()
```



Matplotlib (scatter)

- Desenhar cada ponto independentemente
- Podemos controlar cor e tamanho de cada ponto

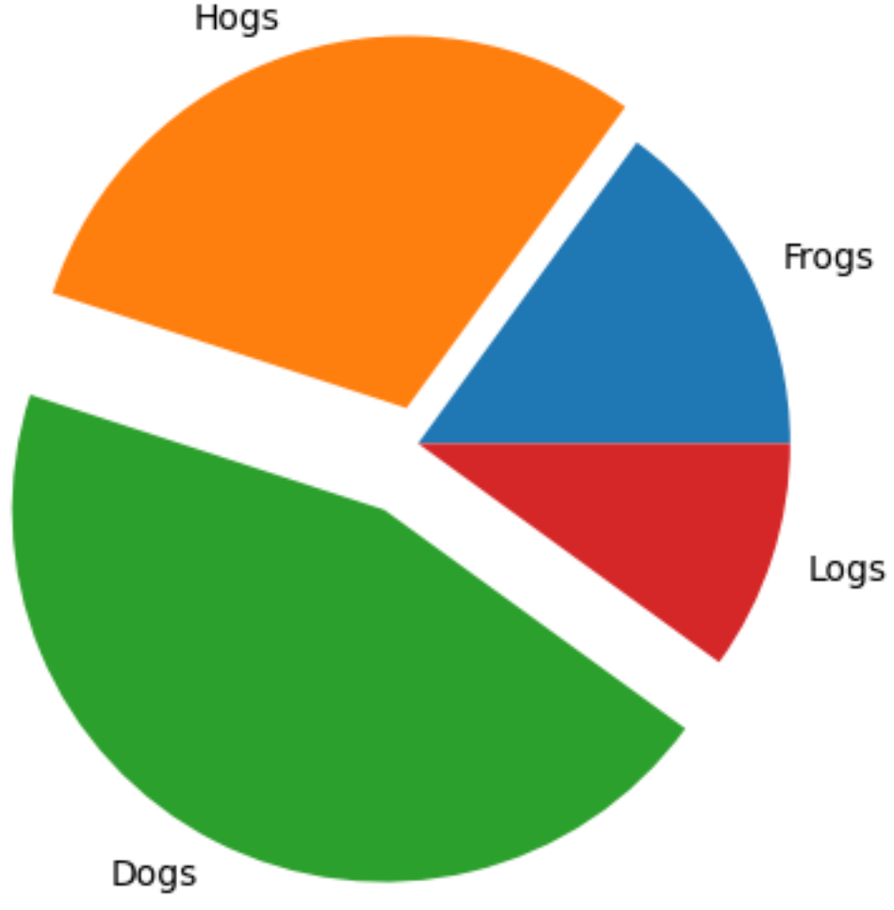
```
xx = np.linspace(0.75, 1.5, 100)
yy = np.random.randn(len(xx))
zz = xx**2
ww = yy**2

plt.scatter(xx, yy, c=zz, s=ww*50)
plt.title("colorized like $x^2$,
sized like y^2")
plt.show()
```



Matplotlib (pie)

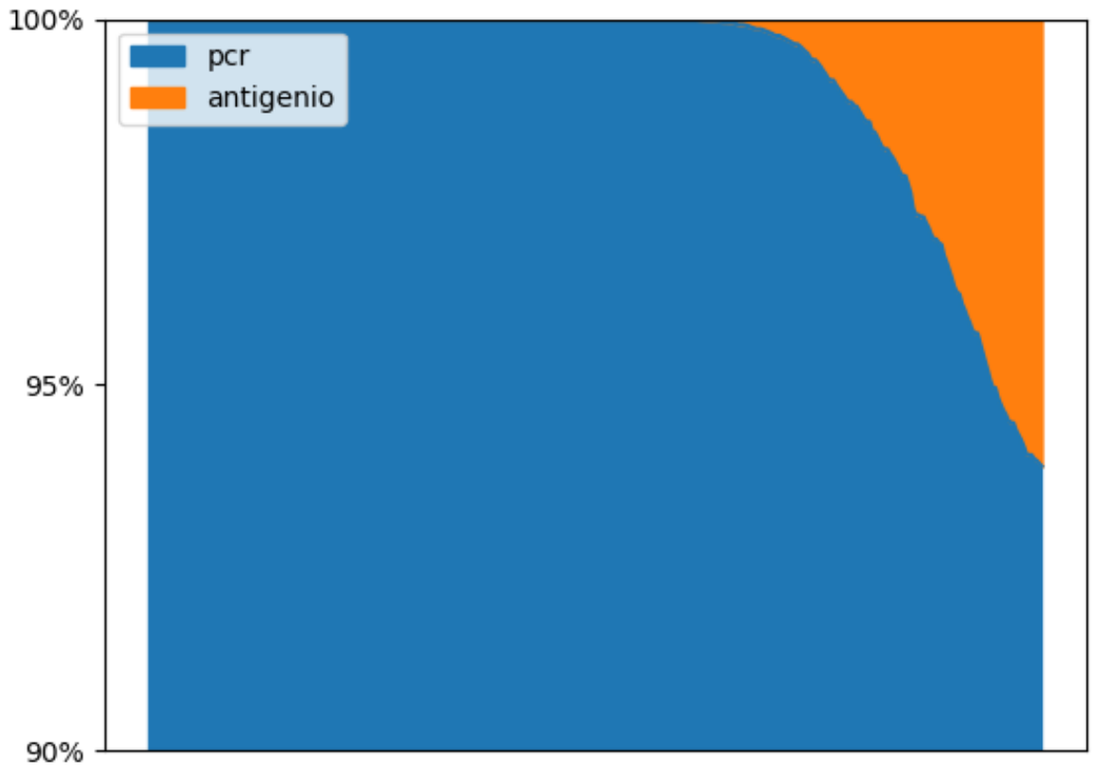
- Desenhar um gráfico em forma de “tarte”
- Podemos controlar expansão de cada fatia

```
labels = ['Frogs', 'Hogs', 'Dogs',
'Logs']
sizes = [15, 30, 45, 10]
explode = (0, 0.1, 0.2, 0)
plt.pie(sizes, explode=explode,
labels=labels)
plt.show()
```



Exemplo 1

- Desenhar um gráfico de áreas que apresente a percentagem de testes COVID-19 de cada tipo ao longo do tempo




```
amostras = pd.read_csv('amostras.csv')
amostras.dropna(inplace=True)

amostras['pcr'] = amostras['amostras_pcr'] / amostras['amostras']
amostras['antigenio'] = amostras['amostras_antigenio'] /
amostras['amostras']
amostras[['pcr','antigenio']].plot(kind='area',stacked=True)

plt.tick_params(axis='x',bottom=False,labelbottom=False)
plt.ylim(0.9,1)
plt.yticks([0.9,0.95,1],["90%","95%","100%"])
plt.show()
```

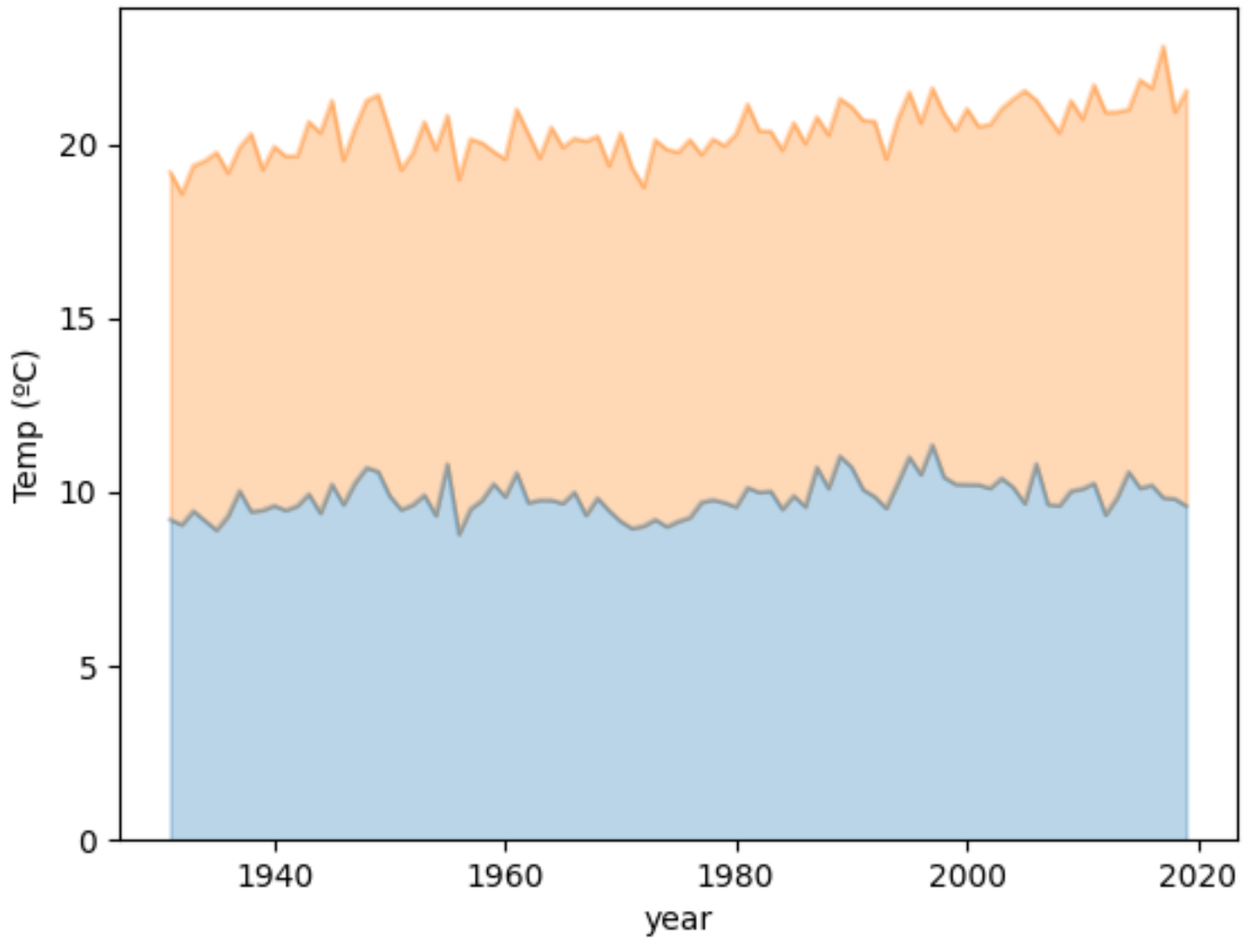
Exemplo 2

- Dados climatéricos anuais de longa duração fornecidos pelo IPMA aqui.
- Gráfico da evolução das temperaturas mínima e máxima por ano

```
dfs = pd.read_excel("PT100-tx-tn-prec.xlsx", sheet_name=None)
years = ['year','Annual']

tmins = dfs['tmin']
tmins = tmins[years].copy()
tmins.dropna(inplace=True)

tmaxs = dfs['tmax']
tmaxs = tmaxs[years].copy()
tmaxs.dropna(inplace=True)

temps = pd.merge(tmins,tmaxs,on='year',suffixes=('_tmin','_tmax'))
temps['year'] = temps['year'].astype('uint16')
temps.set_index('year',inplace=True)
temps['Annual_tmax'] = temps['Annual_tmax'] - temps['Annual_tmin']
temps.plot(kind='area',alpha=0.3,stacked=True,legend=False,ylabel=
'Temp (°C)')
```

Exemplo 2

- Dados climatéricos anuais de longa duração fornecidos pelo IPMA aqui.
- Gráfico da evolução das temperaturas mínima e máxima por ano



Exemplo 3

- Dados climatéricos anuais de longa duração fornecidos pelo IPMA aqui.
- Gráfico de ano, temperatura mínima e temperatura máxima por estação
  - E.g., qual o Verão mais quente de que há registo?

```
dfs = pd.read_excel("PT100-tx-tn-prec.xlsx", sheet_name=None)

seasons = ['Spring','Summer','Autumn','Winter']
yseasons = ['year'] + seasons

# temperaturas mínimas para cada ano e estação
tmins = dfs['tmin']
tmins = tmins[yseasons].copy()
tmins.dropna(inplace=True)
tmins['year'] = tmins['year'].astype('uint16')

# temperaturas máximas para cada ano e estação
tmaxs = dfs['tmax']
tmaxs = tmaxs[yseasons].copy()
tmaxs.dropna(inplace=True)
tmaxs['year'] = tmaxs['year'].astype('uint16')
```

Exemplo 3

- Calcular temperaturas mínimas e máximas por estação, e anos correspondentes

```
# colapsar as estações para índices
tmins = tmins.melt(id_vars=["year"],var_name="season",value_name="tmin")
tmins.set_index('year',inplace=True)
years = tmins.groupby('season').idxmin().rename(columns={'tmin':'year'})
temps = tmins.groupby('season').min()
tmins = years.join(temps)

# colapsar as estações para índices
tmaxs = tmaxs.melt(id_vars=["year"],var_name="season",value_name="tmax")
tmaxs.set_index('year',inplace=True)
years = tmaxs.groupby('season').idxmax().rename(columns={'tmax':'year'})
temps = tmaxs.groupby('season').max()
tmaxs = years.join(temps)
```

Exemplo 3

```
for season in seasons:
    plt.scatter(tmins['year'][season],tmins['tmin']
[season],c=season_color[season],s=200,marker="v")
    plt.scatter(tmaxs['year'][season],tmaxs['tmax'][season],
c=season_color[season], s=200, marker="^")
    plt.scatter([],[],c=season_color[season],s=100,marker='s',label=season)
plt.legend()
plt.show()
```

- Desenhar o gráfico