Visualizing additional dimensions?
m_powers 1d

This video shows an example of visualizing an objective f based on two independent variables (x, y).

A simplified version of another project I am working on (more on this in another post) involves maximizing an objective z based on *three* variables (w, x, y). I suspect there are a number of local maxima and I'm interested in visualizing these in some way analogous to the contour plots in this section. Any suggestions? I've looked through some of this article but all the examples involve two input variables.

Related to 13.2 Multi-variable Optimization / 13.2.2 An introduction to contour plots in Python

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Thanks for this! This helps me visualize a possible approach: 3D scatter plot, but only display values with z above some threshold. Should be able to see hotspots pretty well in that case.

In the example you suggested, it would be nice to be able to slide those cross-section planes around to quickly find coordinates of intersections.

wangaj_mit Staff 1d

I don't have a direct solution, but this came to mind. While you can't see all planes at once, this shows contour/density plots along the three principle orthogonal planes.

https://en.wikipedia.org/wiki/File:Microwaveoventransient.webm

You could also look up how they present CT scans in medicine, where they image a bunch of slices along an axis. If you step through / animate those slices for your function, you could get a sense of where your maxima lie.

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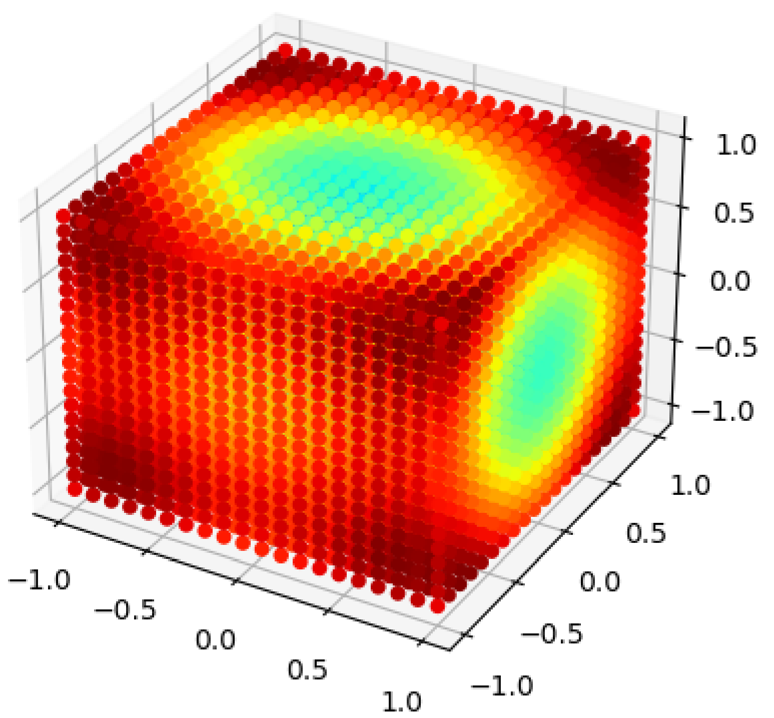
sandipan_dey right now

Could think of the following visualizations, might be helpful.

3D scatterplot with color representing the 4th variable

```
from matplotlib import pyplot as plt
import numpy as np
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
w = np.linspace(-1,1,20)
x = np.linspace(-1,1,20)
y = np.linspace(-1,1,20)
W, X, Y = np.meshgrid(w, x, y)
Z = np.sin(W**2 + X**2) + np.sin(X**2 + Y**2)
ax.scatter3D(W, X, Y, c=Z, cmap='jet', alpha=1)
plt.show()
```



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3D contourplot

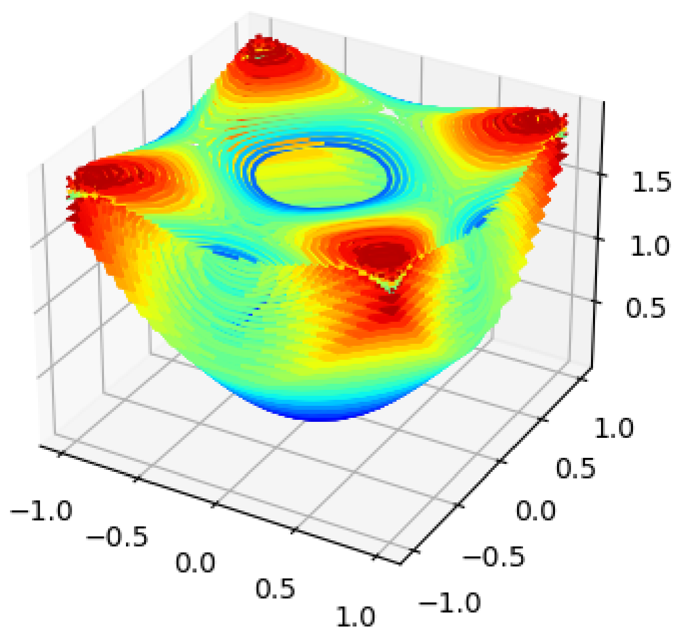
Fix Y and contour plot

```
W, X = np.meshgrid(w, x)
fig = plt.figure(figsize=(20,20))
i = 0
for Y in np.linspace(-1,1,64):
    ax = fig.add_subplot(8, 8, i+1, projection='3d')
    Z = np.sin(W**2 + X**2) + np.sin(X**2 + Y**2)
    ax.contour3D(W, X, Z, 50, cmap='jet')
    ax.set_title(f'Z={Z:.3f}')
    i += 1
plt.show()
```

Contour plot for all Y values together

```
from matplotlib.colors import LinearSegmentedColormap

colormap = LinearSegmentedColormap.from_list('custom',
                                       [(0, '#00ff00'),
                                        (1,   '#ff0000')], N=256)
W, X = np.meshgrid(w, x)
ax = plt.axes(projection='3d')
for Y in np.linspace(-1,1,64):
    Z = np.sin(W**2 + X**2) + np.sin(X**2 + Y**2)
    ax.contour3D(W, X, Z, 20, cmap='jet')
plt.show()
```



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