Assignment-4

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Direct Visualization

In this assignment, we first start by implementing the grid-based visualization. The figure below shows an example of the vector field visualization using d3. The five buttons ('Normal/Jitter','Increase Points','Decrease Points','Increase Vector Length','Decrease Vector Length') give interactivity to the visualization. The number of sample points can be increased or decreased, and the vector length can be varied. The first button toggles between the grid (shown below) and jitter (extra credit) visualization. It should be noted that even for the data points which have low intensity (short vectors), the arrowhead still correctly represent their directions. This was the reason behind choosing the arrowheads that have been in used in the figure below.
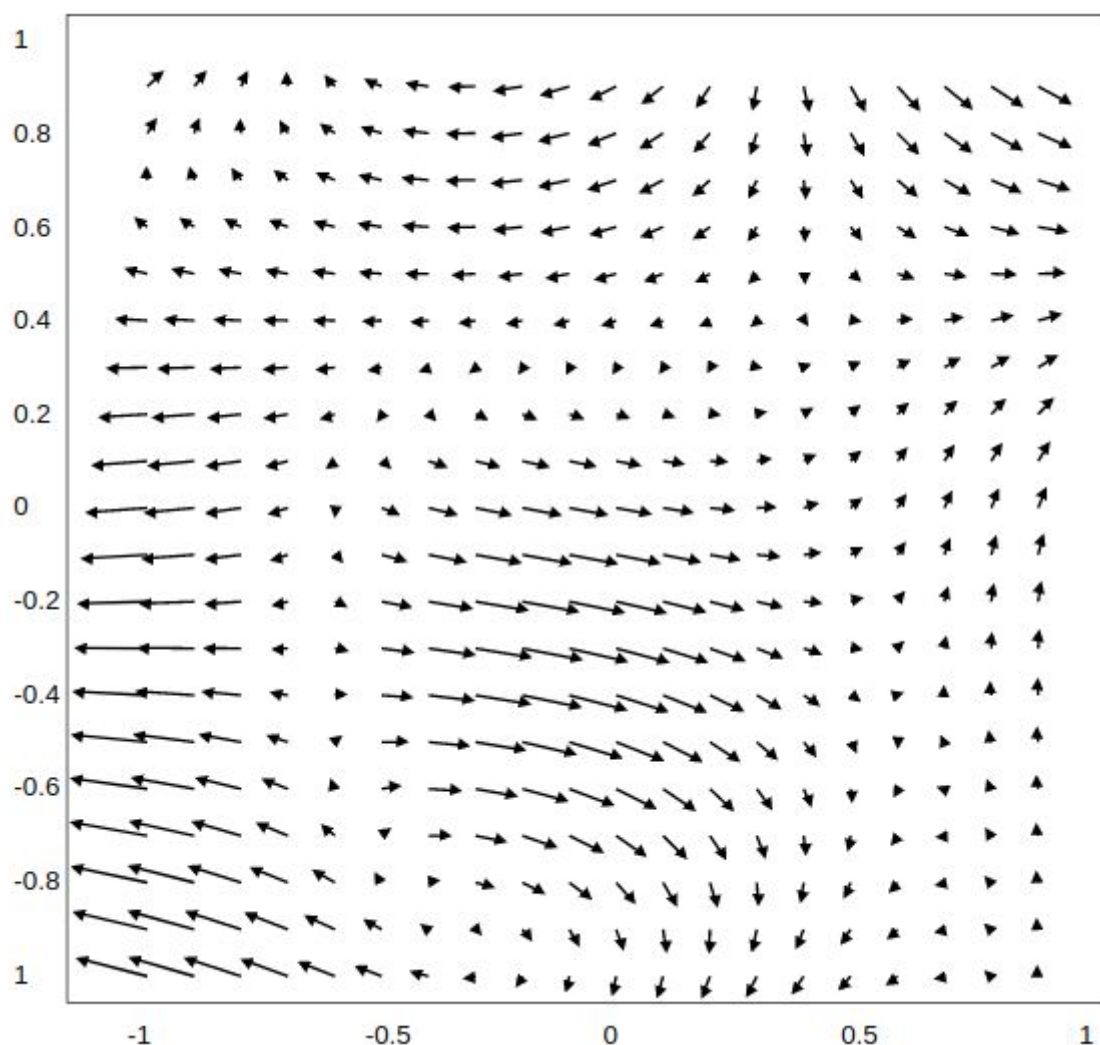

Figure: Grid Visualization of Vector-Field data

Experimentation

(1)

1. The first thing that can be observed from the visualization is that there are several major vector forces being applied. Which is true because the dataset was generated using seven random vectors. The figure below shows approximate vectors that can be inferred from the vector field visualization.
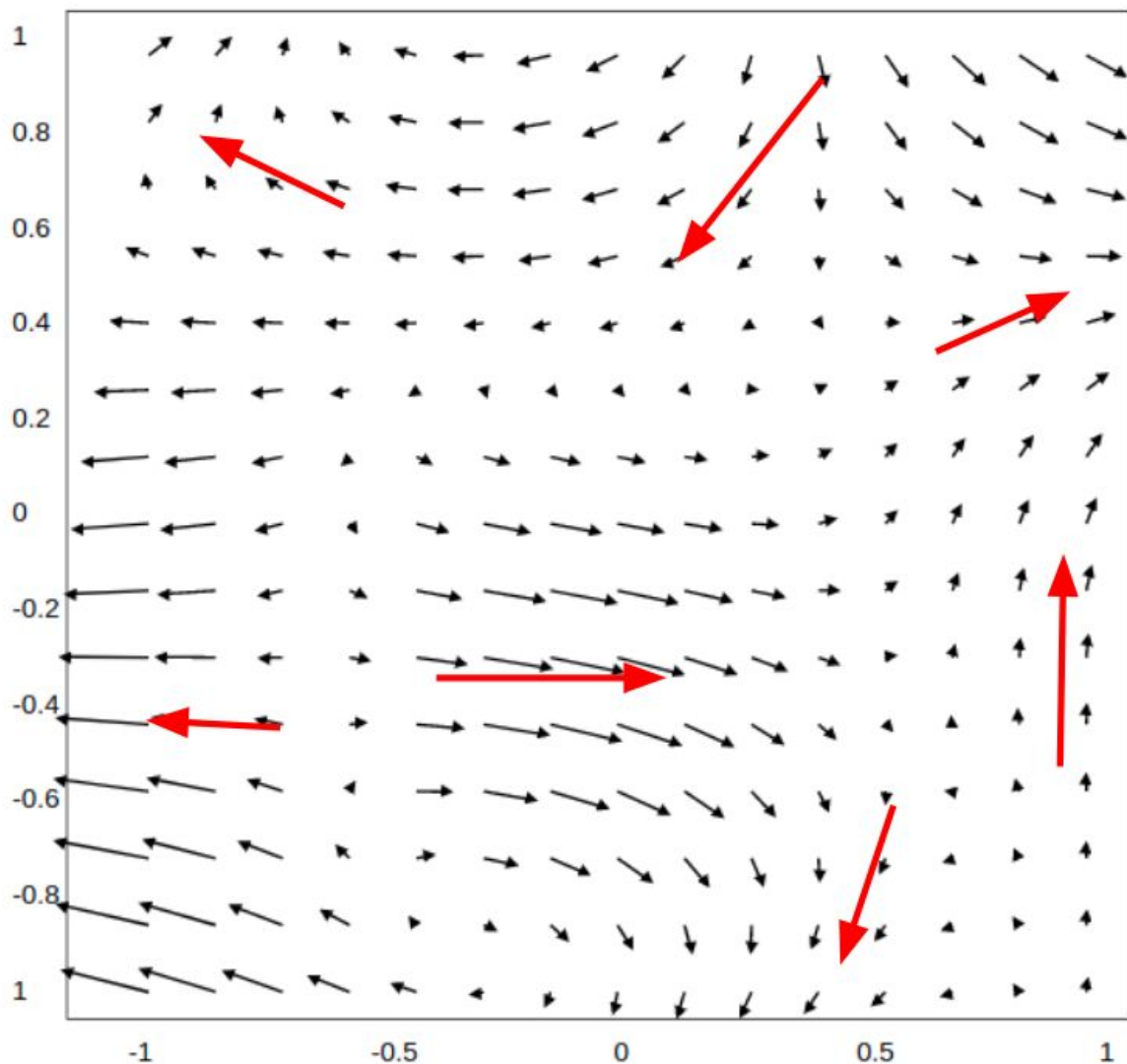

Figure: Approximate seven vectors inferred using the visualization.

2. Increasing the sample points and vector length makes it easier to find the areas with the highest magnitudes. The image below shows the top three areas with highest vector-field magnitude found on increasing the number of sample points and increasing the vector length. This might be helpful in certain domains, e.g. locating the low and high-pressure areas on an airplane wing etc.
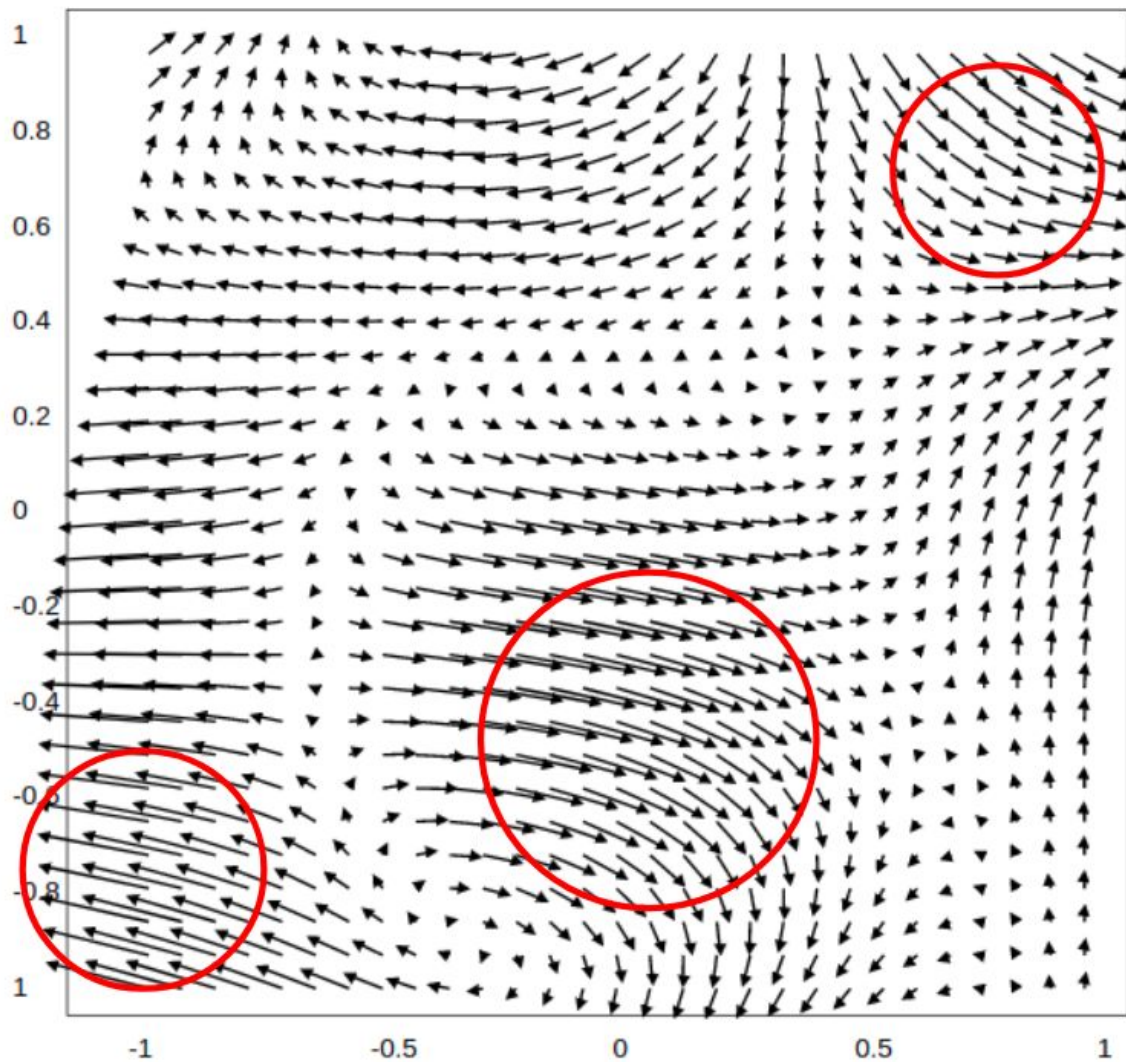
Figure: The circles show areas where the magnitude of vector-field is maximum.

3. The jitter visualization gives a more natural view of the data. The figure below shows an example of one such visualization. This is generated by selecting random data points and then re-computing the vector magnitude and direction by averaging the neighbor vector fields.
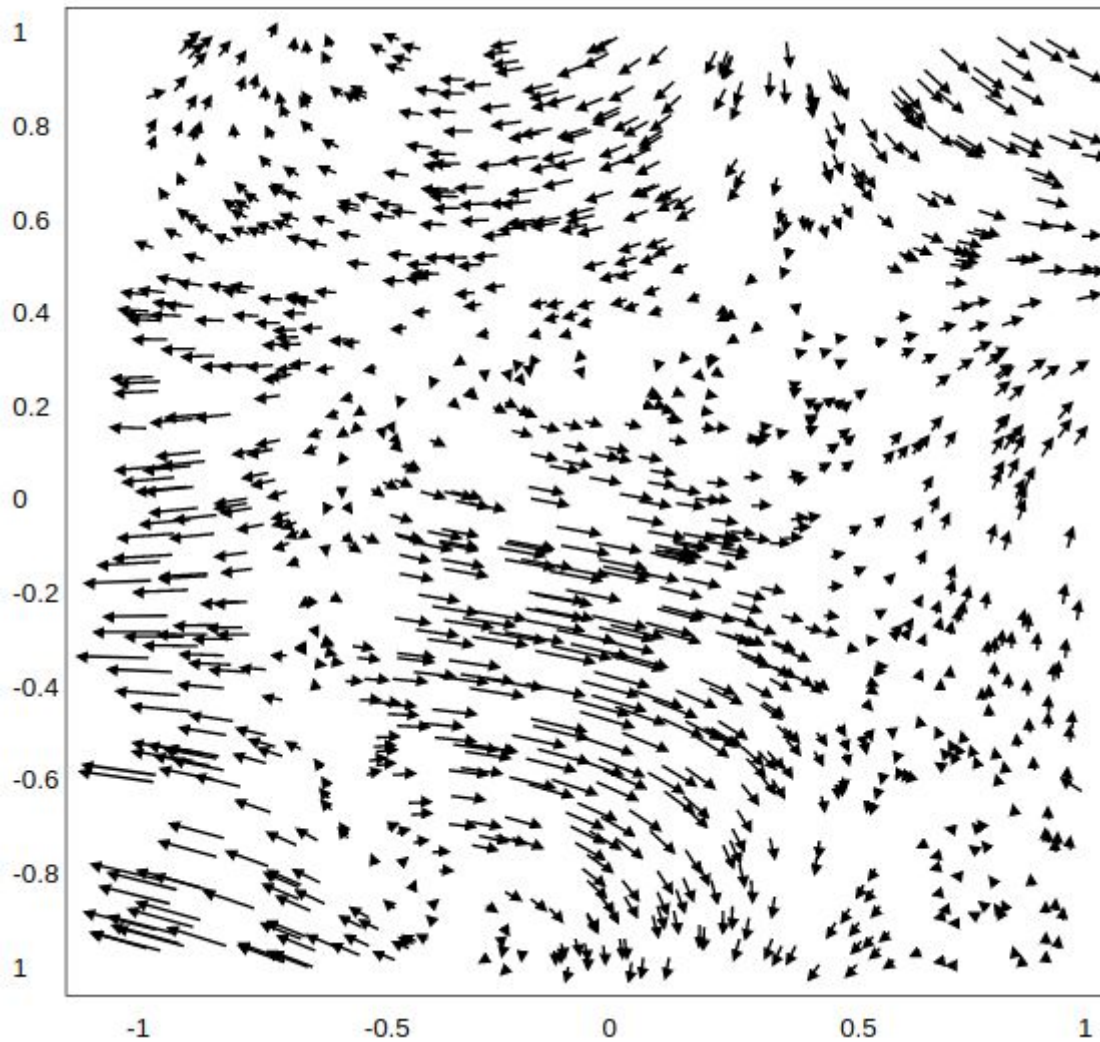
Figure: Jitter implementation of the vector-field.

(2)

1. Increasing the number of sample points gives a better overall picture of the dataset. As seen above increasing the length of the vector helps in locating the local maxima and minima.

2. But on increasing the number of sample points beyond a point makes the visualization noisy. Consider the example shown below. This visualization makes it very hard to infer anything about the dataset.
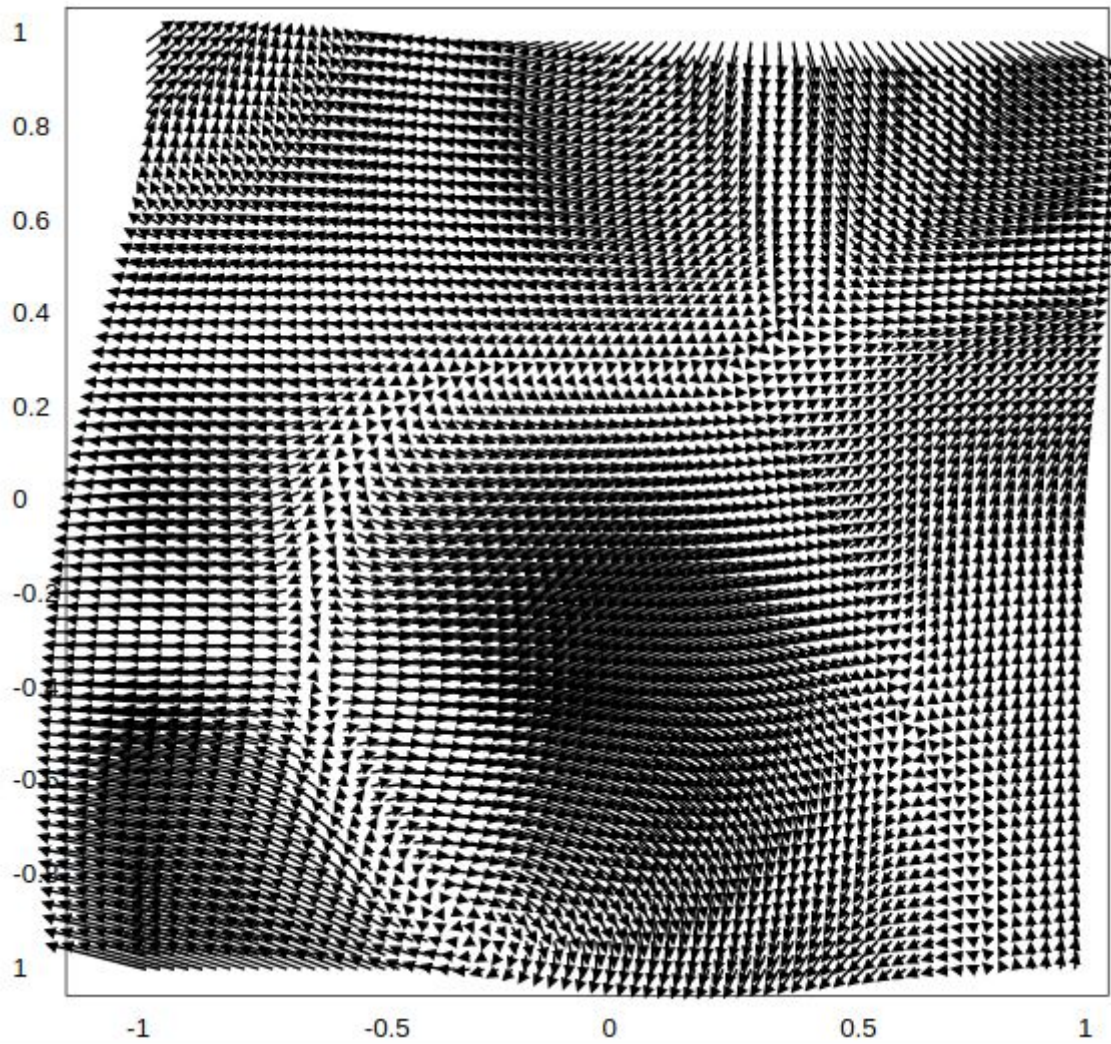
Figure: Too many sample points on grid.

3. Also, as we saw above, replacing the above visualizations by jitter method gives a more aesthetically pleasing image and improves the user experience.