Application of coordinate mapping in data visualization

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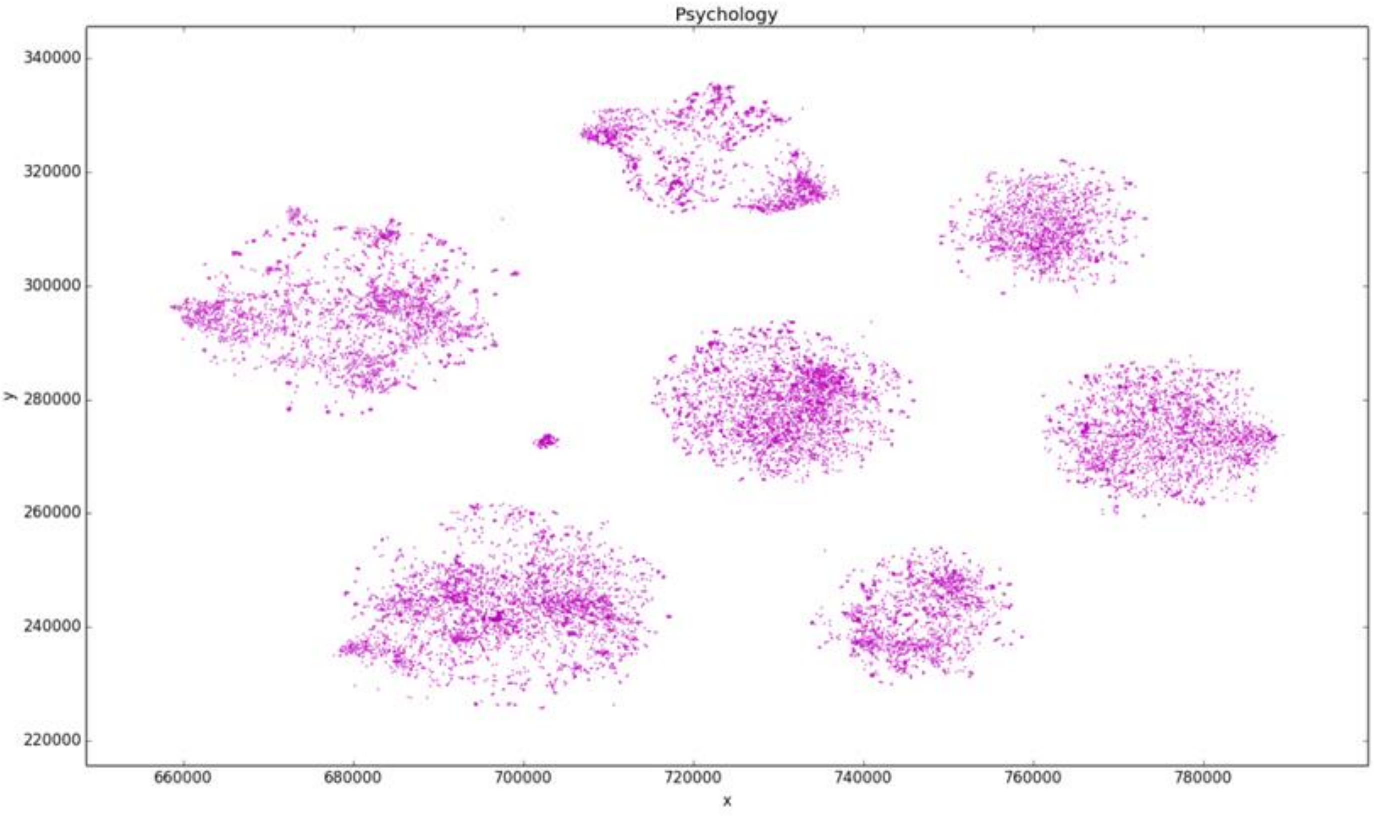
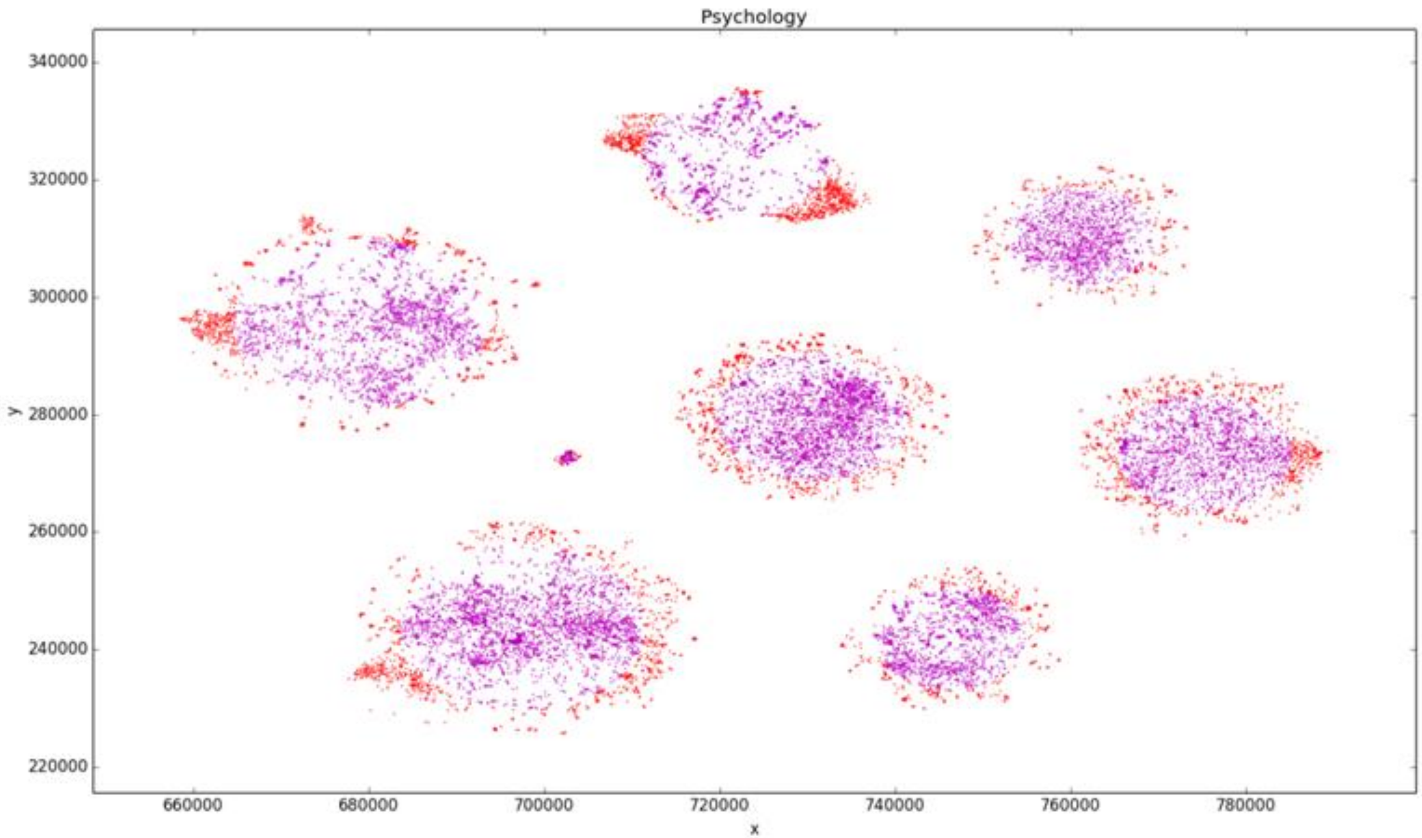
Preview

- **Original layout**
- **Linear coordinate mapping algorithm**
- **‘Electron orbit model’ algorithm**
- **Comparison with force guidance algorithm and Conclusion.**

Original layout



Linear coordinate mapping algorithm



Points selection

A. Find the boundary points of each L1 and Calculate the xmax, xmin, ymax, ymin:

B. Calculate the center coordinates OX, OY of each L1 with the formula below:

$OX = (xmax + xmin)/2 \qquad OY = (ymax + ymin)/2$

C. Calculate the radius of each L1 with the formula below:

$$R = \max\{\left(\frac{xmax - xmin}{2}\right), \left(\frac{ymax - ymin}{2}\right)\}$$

D. Select the points the distance of which to the field center is between [R*Ration, R] with the formula below: $x^2 + y^2 \geq (R * Ration)$^2

E. If *Ration* =0.7, the selected points are showed in **red** in the picture below(***figure-6***):

Linear coordinate mapping algorithm

Linear coordinate map the selected points from [R*Ration, R] to [R*Ration, R*n] with the formula below:

$$d = \sqrt{(x - OX)^2 + (y - OY)\text{^}2}$$

$$\sin\theta = (y - OY)/d$$

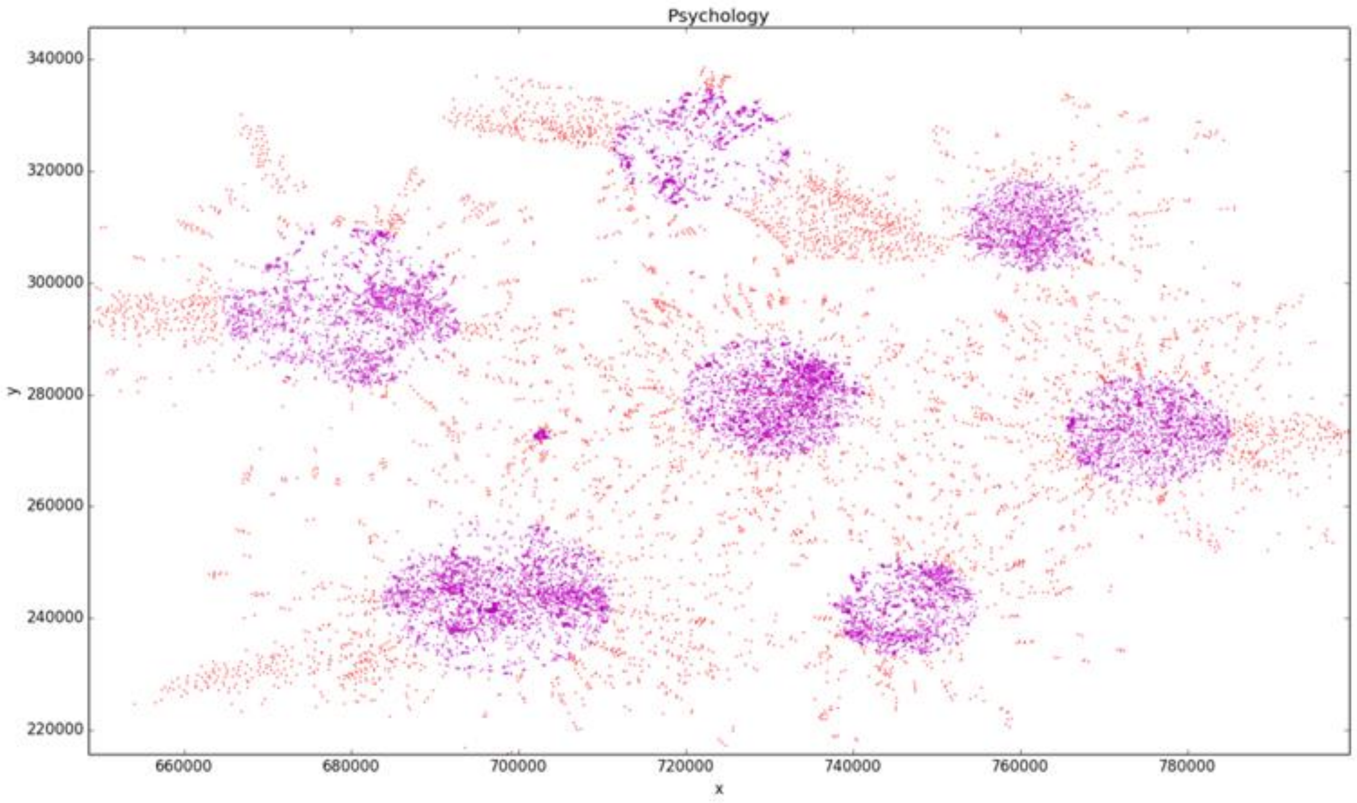
$$\cos\theta = (x - OX)/d$$

$$Newd = (d - R * Ratio) * (n - Ratio)/(1 - Ratio) + R * Ratio$$

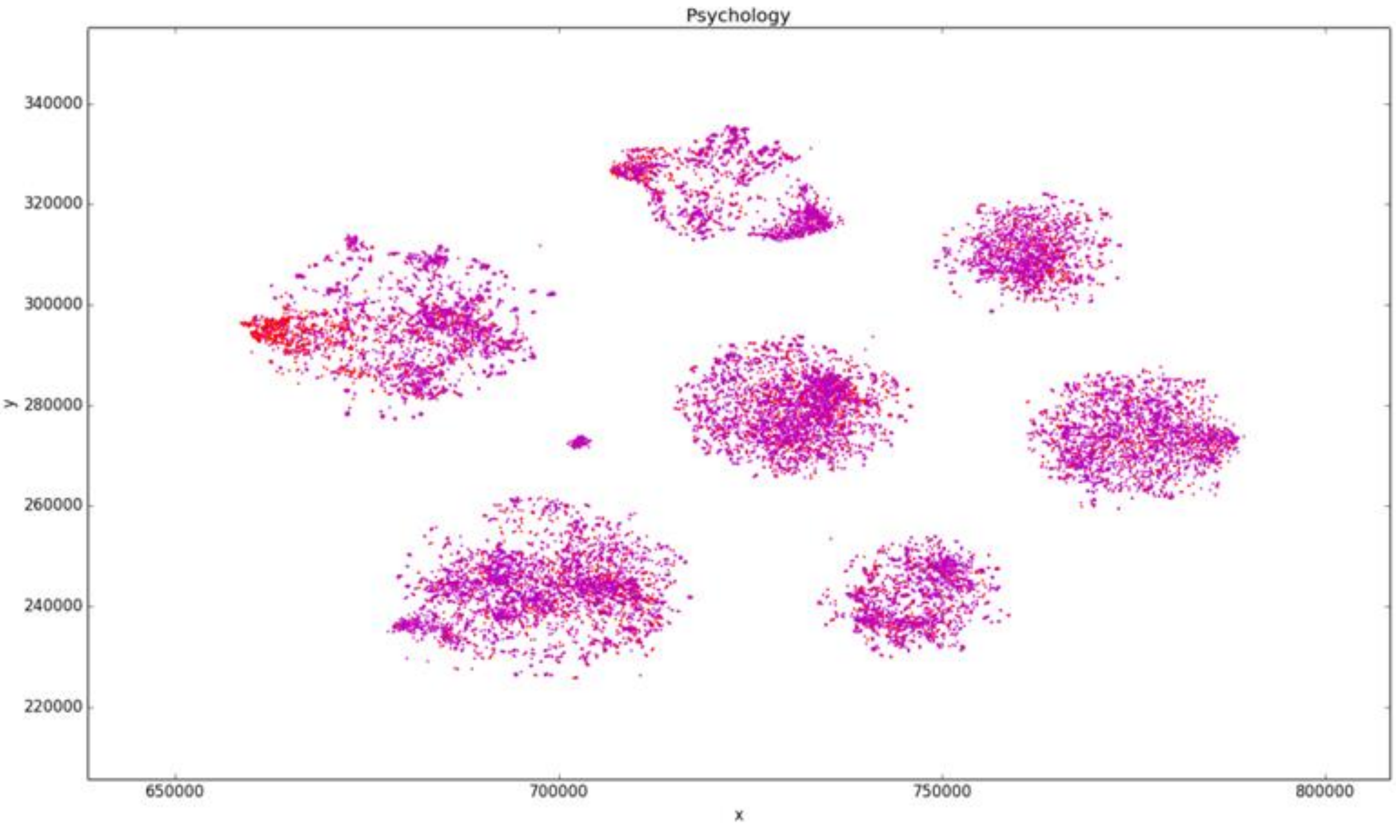
$$Newx = Newd * \cos\theta + OX,\ Newy = Newd * \sin\theta + OY$$

When n=2, Ratio= 0.7, the result of mapping is showed in **red** in the picture below(figure-7):

Linear coordinate mapping algorithm



‘Electron orbit model’ algorithm



‘Electron orbit model’ algorithm

A. I define the ‘energy’ of each paper point by the formula below:

$$Energy = OC/IC$$

If IC=0, appoint Energy = 10000.

B. For each field1, sort the paper points by their energy from high to low.

C. Select the former *Ration%* of the sorted paper points as points to be

mapped.

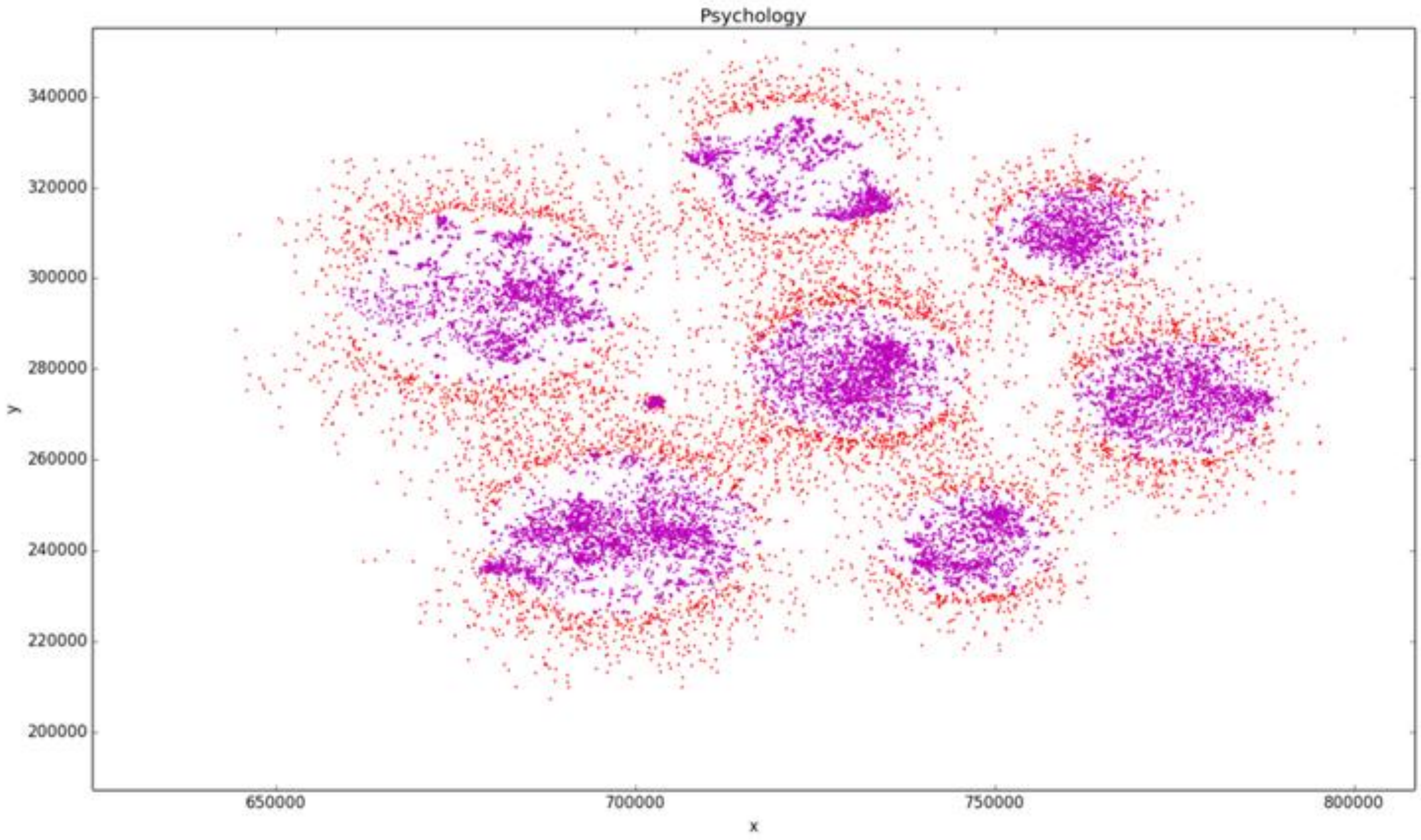
The selected paper points are showed in **red** in the picture below(***figure-10***):

‘Electron orbit model’ algorithm

I name this coordinate mapping algorithm ‘Electron orbit model’ algorithm due to the similarity of this algorithm compared to the position of each electron in an atom. Electron with different energy level randomly show up in the orbit with different energy level. Those selected papers will show up in the distance region [R-R*n1,R*n2] on different energy orbit according to their ‘Energy’. The high energy a paper has, the higher possibility that the paper point show in longer distance to its field1 centre is. The ‘Electron orbit model’ algorithm code is showed in the appendix.

When n1=0.2, n2=2, the mapping result is showed in **red** in the picture below (figure-11):

‘Electron orbit model’ algorithm



Comparison with force guidance algorithm and Conclusion.

- Force guidance algorithm forces paper points to interact directly with one and another which makes the dispersion of paper points with strong sense of direction. However, the calculation quantity is very huge and it is impossible to process all the paper points with this algorithm. If only process part of the points with force guidance algorithm, it is meaningless.