Algorithm for stickiness prediction of Diffusion Latent Aggregation images

Variables:

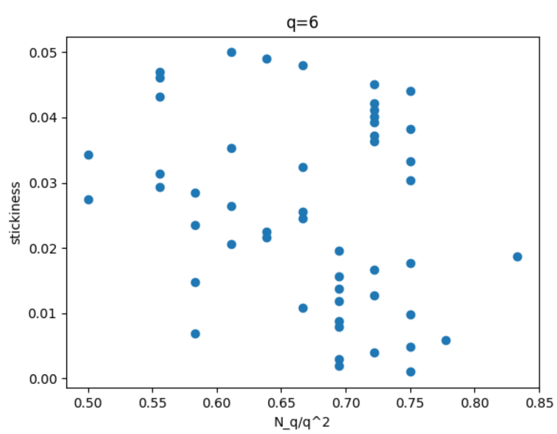
- **M:** size of the matrix
- **N:** total particles in the matrix
- **q:** size of the square shaped section cut from the matrix for analysis.

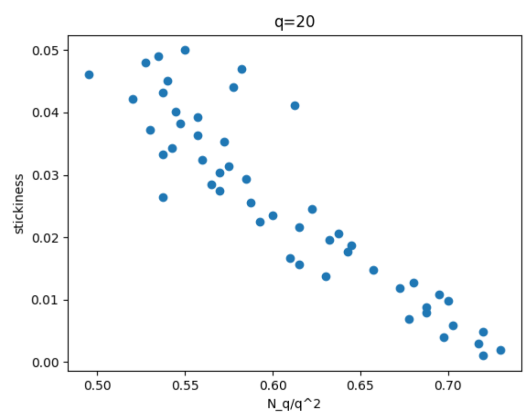
Observation:

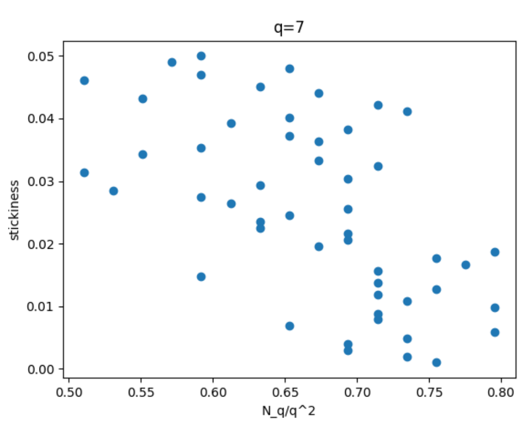
1. When the *stickiness* is **high**, **less** *no. of particles* get to the *central part* of the matrix because they are likely to have stuck to another particle on its way to the centre. Thus we can expect an inverse correlation between No. of particles in the central tile and the stickiness of the particles.
2. After **N** crosses a particular threshold, particles are very less likely to get to the central part of the matrix. Thus, the no. of particles found on the central section of the matrix becomes constant for sufficiently large **N**.

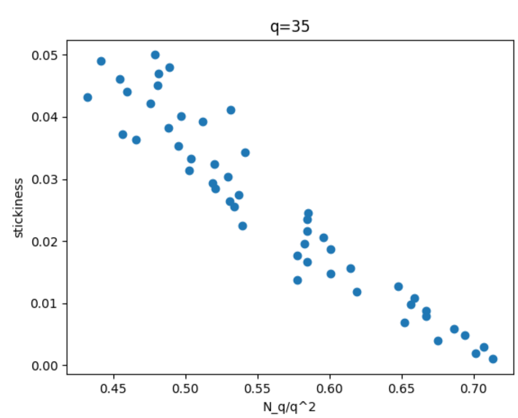
Hypothesis: Number of particles found at a **q(<M)** sided square shaped section of the **M** sized matrix located at its centre varies with the **stickiness** of the particles on the matrix.

Scatter plots for Central Particle Density(x) vs. Stickiness(y):





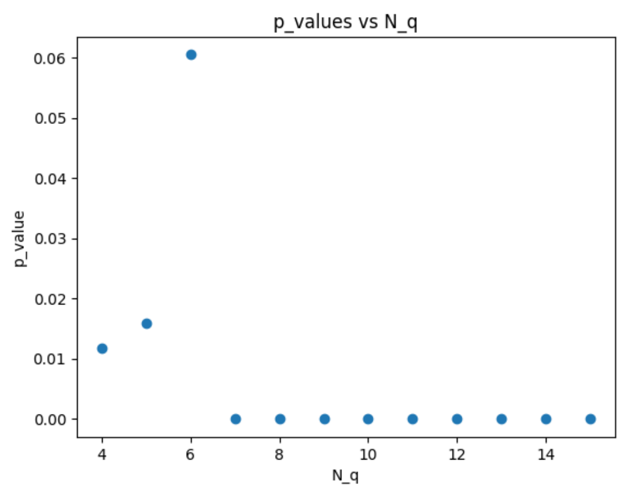




We observe that the correlation between the central particle density and stickiness breaks down at lower values of *q*.

Statistical significance using pearson correlation and p-values:

To inspect the statistical significance of the correlations found above we inspect the p-value of the test statistic for different values of *q*.



Here, we observe that the p-value drops to ~0 at q=7. At q=6, we get a 0.06 p-value. This means that at q=6, there is a 6% chance that the correlation observed is random. This is enough to reject the hypothesis that the variables are correlated.

Algorithm for stickiness estimation:

Using the observations above, we can propose the following algorithm for stickiness estimation:

Input: N(No. of particles), k(stickiness)~[0.001-0.05]

If N>300:

    # confidence zone
    Find central particle density using q = 20.
    Use Linear Regression to predict stickiness,
    Stickiness = -0.1741***Central Particle Density** + 0.1233

Else if 300>N>40

    # low confidence zone
    Find central particle density using q = 7
    Find central particle density using q = 7
    Use Linear Regression to predict stickiness,
    Stickiness = -0.1741***Central Particle Density** + 0.1233

Else(N<40)

 # no confidence zone

We need to find some other methods for predicting the stickiness.

Note:

1. q must be selected such that the central square is covered with particles and if a new particle were to be introduced in the matrix, it would have almost 0 probability of sticking inside the selected q-sized square.
2. The numbers 300 and 40 were picked using the above rationale. 300 is the no. of particles that lie inside the 20x20 square at minimum stickiness and 40 is the no. of particles that lie inside 7x7 square at minimum stickiness.
3. We can improve performance by further discretizing the low confidence zone to adjust *q* according to the N given.