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*Critique of Article “Diffusion-Limited Aggregation, a Kinetic Critical Phenomenon”, T.A. Witten, Jr. and L.M. Sander, Physical Review Letters 47 (1981), pp. 1400-1403.*

The paper helped me better understand the logistics of the forming of a diffusion-limited aggregated cluster. The main difference between the Eden model and the Diffusion-limited aggregation model is that in Eden model, cluster’s density correlations are independent of distance in the limit of large size. In Diffusion-limited aggregation (DLA), the density of an area has a fractional power-law relationship with its distance to the center. The two graphs in the article also functioned as a clear explanation of DLA. As we see in figure 1, the random aggregation of 3600 particles on a square lattice, the result is hardly a compact cluster and the exposed end of the cluster tend to grow more rapidly than other perimeter sites because perimeter sites near the center are “shadowed”. Figure 2 provides a more quantitative aspect of DLA: since the function is averaged over six aggregates as a function of distance, it’s clearly visible that the data are consistent with a power law over distances, and has scale-independent correlations over an arbitrary large range of distances (the shape/intercept of the line doesn’t vary with r).

Although the article provides a clear fundamental understanding of DLA, there are some confusing details which can be clarified/explained more. Firstly, the formulas rarely contributed to my reading, nor did they make much sense to me. Since the reader is not benefiting from those complicated and intimidating formula, it’d be better to reconstruct them in a simple way, or leave some space for explanation. Secondly, since the paper is mainly explaining the correlation of density and distance, when it brings up the probability that a perimeter site at x gains a particle at step n, I agreed with the author’s conclusion that it’s proportional to the number of walks arriving at r in n steps. But later I think the claim needs further discussion, especially when new ideas are introduced later based on that.

Our research group could work on extensions of realistic dendritic growth with surface tension by making the sticking probability of particle smaller or larger for perimeter sites with fewer or more neighbors as mentioned in the paper, so as opposed to exposed ends have a higher chance of growth, a more compact ends/area will attract more particles.