BRIEF NOTE - CD AS 'GREEDY CRITERION'

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1 Note

Our previous efforts have strived to use *current-displacement* (CD) as a means to adjust results given by the adjoint-based Greedy heuristic (GH). While those ideas were never fully developed due to unforeseen (yet inherent) difficulties, it was suggested CD could be used as the *greedy criterion* (GC) in a new Greedy heuristic.

We recall our definition of the CD vector,

$$\mathbf{D}'(i) = a\left(-\mathbf{J}^{tot}(i) + b\sum_{\substack{j=1\\ j\neq i}}^{n}\mathbf{J}^{s}(i,j)\right) \tag{1}$$

which gives us the displacement at a location i from both tissues and all seeds not at i.

Because seed locations and the requisite current information is all known *a priori*, the CD vector gives to us a means to "push" seeds away from each other and sensitive tissues. However, when we do not have *a priori* knowledge of seed locations, this mechanism seemingly breaks down as in its application as the GC. If we rank position by $||\mathbf{D}||_2$, we first must sum the individual x and y components (of J^{tot} etc.). However, as these components by their very nature consider direction, we can devise a scenario in which a location, while having a very low $||\mathbf{D}||_2$ value, is absolutely not where we would choose to place a seed.

Imagine a seed placed at (x_1, y_1), after which we recompute and rerank CD. Then, let a second (or some other subsequent) seed be placed at $(x_1 + \alpha, y_1)$ where α is reasonably small yet large enough for the seeds to have adequate spacing. Now, because the seed currents are set such that a seed dominates in its immediate vicinity, we note that exactly in between these two seeds, the y-component of current exists solely due to tissues and that the x-contributitions from each are exactly opposite in direction and equal in magnitude; thus, the x-component cancels. Because we have only the y-component to factor into the norm, we can imagine this spot could be ranked quite favorable which should *not* be a sought outcome!

So what can we do?

Instead of keeping direction–i.e. keeping negative signs–we can make everything an absolute value (i.e. $||[\ ]||_1$ norm).