Re: Disjoint circle merge NP complete for L^n error?

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- *From*: "Gene" <eugene.ressler@xxxxxxxxxxxxxxx>
- *Date*: 30 Jun 2005 08:05:12 −0700

Thanks very much Torben for looking at this.

You describe the natural heuristic in P for which we already have good data structures and algorithms worked out. This heuristic can produce arbitrarily bad results because any "merge iteration" can both break overlaps that already existed and create new ones (this can be seen in the proof). In the worst case, it puts ALL the data points in a single circle when only ONE PAIR needs to be merged.

The key point is that we need to be sure there is no optimal algorithm in P before we implement a heuristic that could do dumb things. Hence the need for the NP−hardness proof. This IS the scenario in the Intro of Garey and Johnson!

So we have the proof for a specific case L^\infty and need to extend it to L^n.

I differ with you on the need for more information. The problem is completely described in the proof at the link. The error function merely defines a "good" partition of data points. Smaller error is good. We only need to erase MAX and replace with SUM in the proof problem statement and either fix it or give an optimal (guaranteed minimum error partition) algorithm in P.

For those unfamiliar with L^n metrics, MAX and SUM are merely two cases. In this problem the L^n form of error would be

error(S) = \root{n}{ \sum_{i} |p_i − p|^n }

One can easily check that with n=1 this is SUM and with n−>\infty it is MAX. I'm pretty sure that if both these are in NP then all L^n metrics are also. That's why we're focused on SUM. On the other hand if SUM is in P, that's pretty fascinating and surprising in its own right, and we will have to start checking n=2,3,...

Thanks again!

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- ***References***:
  - ***Disjoint circle merge NP complete for L^n error?***
    - *From:* Gene
  - ***Re: Disjoint circle merge NP complete for L^n error?***
    - *From:* Torben Ægidius Mogensen

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