SWINBURNE UNIVERSITY OF TECHNOLOGY

Crowdsourcing NP-Complete Problems on the Web!?

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Complex Intelligent Systems

Human-Driven Computational Intelligence?

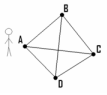
- Last Monday: *What if…*
  - Humans solving localised problems (like Ants? Birds? etc..)
  - Use the Web as the Interface
  - Aggregate contributions into a holistic solutions
- Could we solve really hard problems?
  - NP-Complete? AI-Complete?

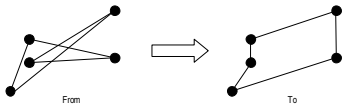
Why the Web?

- Web: Lots of humans with lots of time
- Examples:
  - Mechanical Turk ($ for click labour)
  - Citizen Science
    - galaxyzoo, …
  - Games with a Purpose
    - reCAPTCHA, ESP, Peekaboom, etc.

Problem & Approach

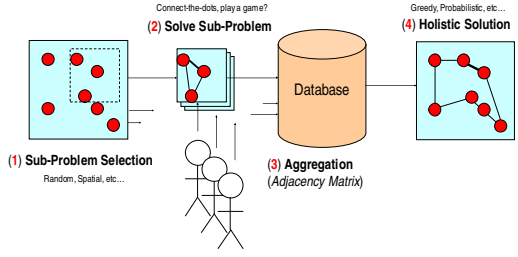
- TSP: Travelling Salesman Problem
  - NP-Complete, Familiar, Well Understood
  - Easily Partition into Sub-Problems (sub-tours)
- General Approach
  - Do Something like Ant Colony Optimisation with Humans
  - Work on Sub-Problems: *Localised Stepwise Construction*
  - Exploit human pattern recognition!!! (underlying structure?)





Top TSP Picture from Wikipedia: http://en.wikipedia.org/wiki/Travelling_salesman_problem

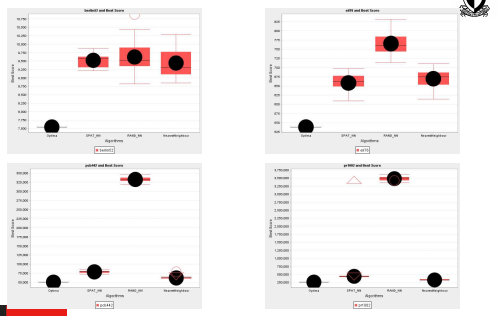
TSP System Overview



Is The System Viable?

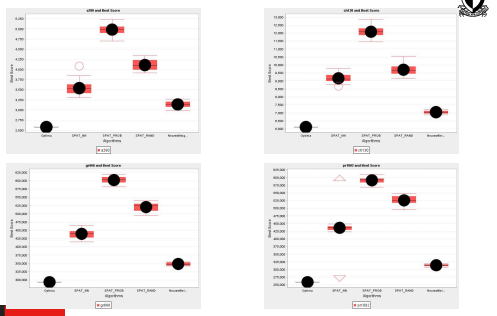
- Is a human *at least* as good as Nearest Neighbour?
  - **I Suspect Better: Innate Spatial Intelligence!**
- If so, does the system work under this assumption?
  - What Sub-Problem Selection Scheme?
  - What if Human Users Suck?
  - What is happening inside the database (adjacency matrix)?

What Sub-Problem Selection Scheme?



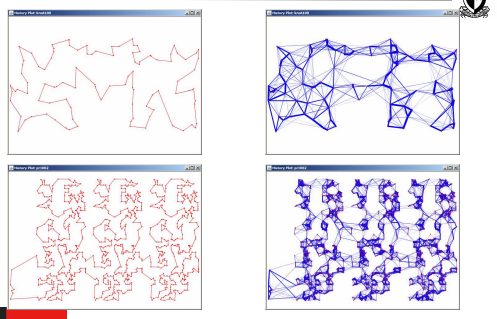
Spatial sub-problem generation is generally better than **Random**!

What if Human Users Suck?



Garbage-in, Garbage-out, as expected.

What is Happening Inside the Database?



Collecting interesting information, **how do we use it effectively**?

Where the Project is at:

- Java Codebase (*Experimentation with OAT*)
- Web Application Prototype (*Ruby on Rails*)
- 4 Technical Reports (*with 3 Experiments*)

Open Problems: Any Thoughts?

Collect Useful Information

- ☐ Visually Motivate With Heuristics? History? How Much?

Extract Useful Information

- ☐ Emergent Solution from Degenerate Sub-Solutions?

Motivate Participation

- ☐ Drawing? Game? Competition? Gimmick?
- ☐ Fly a Spaceship? Topography? Polynomial Transformations?