Course Recap/Summary

Even “old” methods are worth knowing…

- Search – particularly A* (taught in almost all(?) first year AI courses over the last 20 years)
  - Used in many existing applications, and even applied “recently” in computer vision (robust fitting)
- Widely reading literature may likewise bring “old”/established ideas from one area to shed new light on current research in a new area…Boolean function theory (specifically influence -> new way to “attack” maxCon)
- The underlying formalization of these concepts is sufficiently general to apply widely – even if you have no interest in MaxCon/Computer Vision

Learning concepts from mathematics around these “areas” may lead to a deep ubnderstanding of your problem

- Hypergraphs, simplicial complexes, Boolean functions, all have a rich and still expanding maths literature…
  - This literature – the ideas present, the questions asked, the results/bounds, etc….all might lead to a new innovation in your problem
  - You could be the “first” to apply a new result in these areas to your problem
  - You could be the first to apply an old result from these areas to your problem

  - Beginnings of a taxonomy of “data complexity”?
  - Fuller understanding may suggest new things that can be exploited to improve algorithms (or better understand results of algorithms on particular data…)

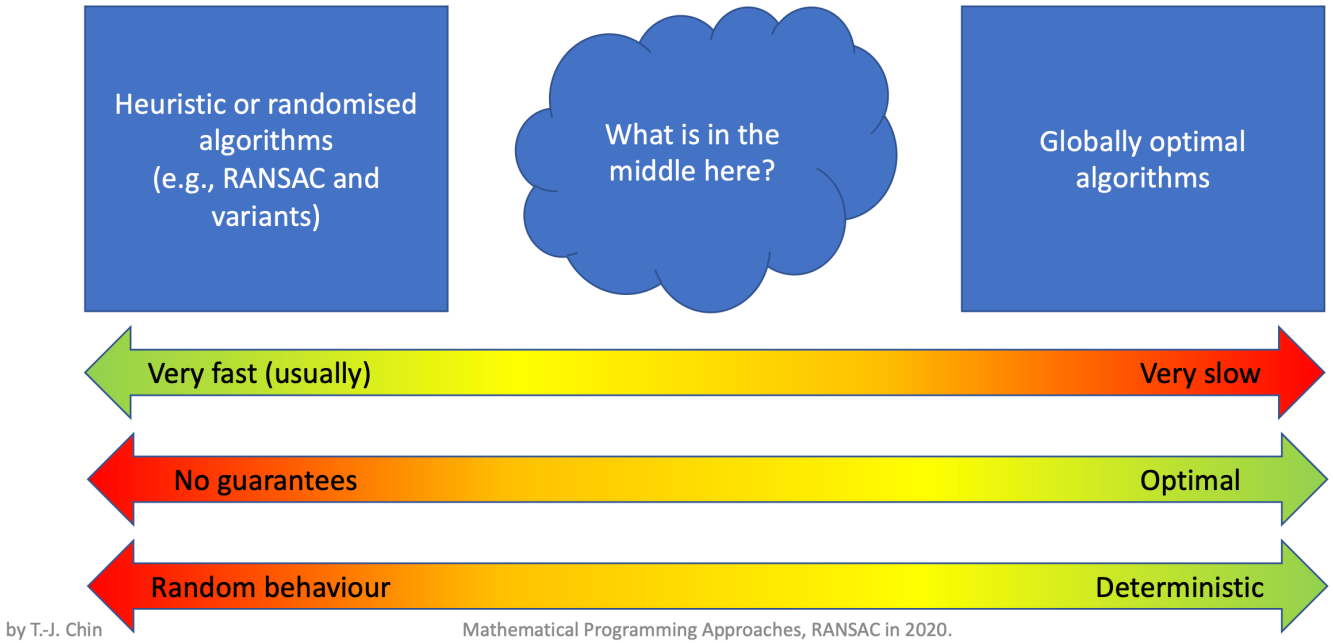
But of course, sometimes it is good to “move with the herd”

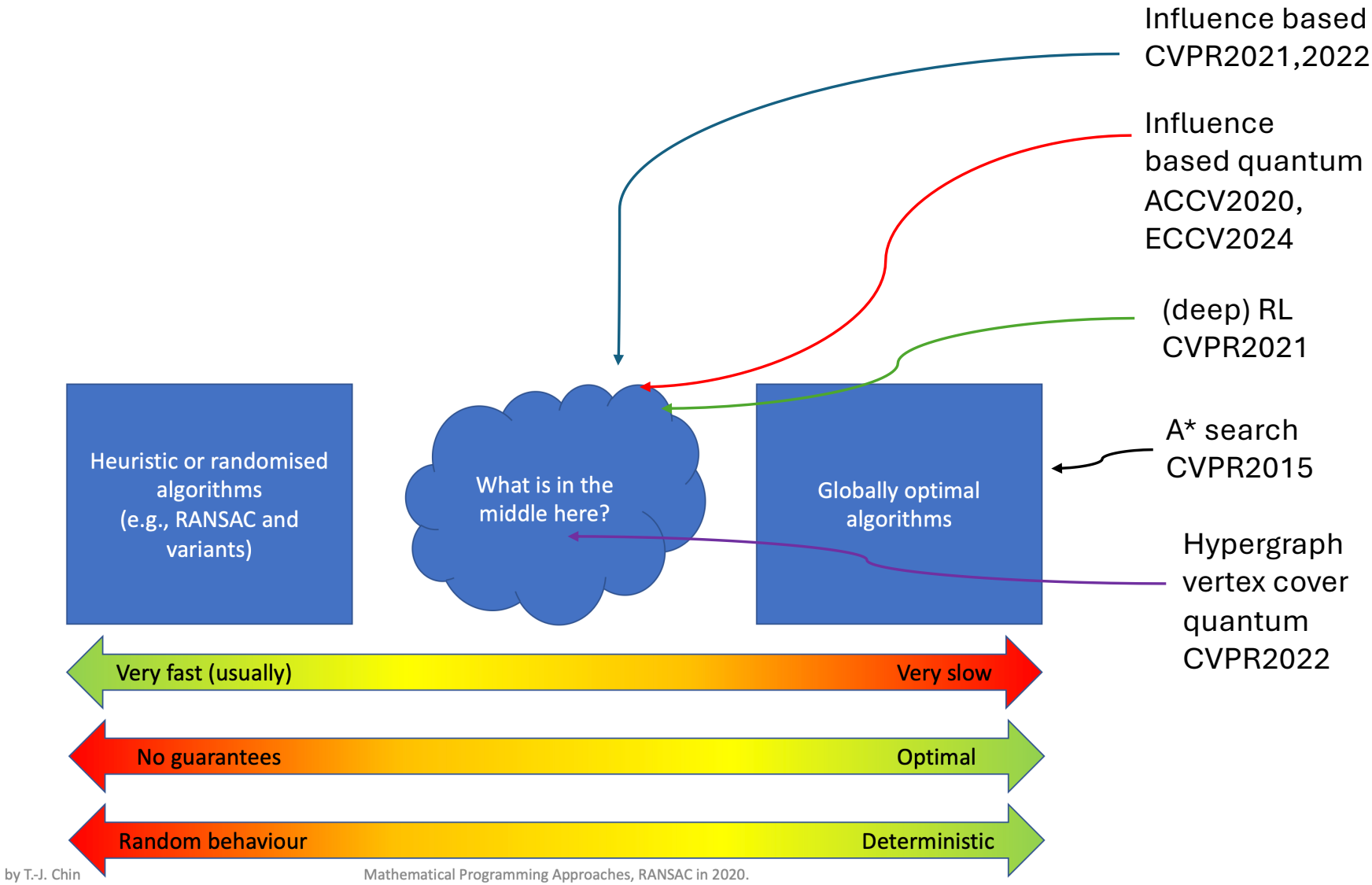
- E.g., deep learning revolutionizing, progressively many things.

Deep learning changing the effectiveness of reinforcement learning (already popular) methods -> being “the first to apply RL, let alone deep learning RL, to your area”

Or “move with the herd” to quantum computing….

Given pointers to examples of these for Computer Vision (MaxCon, of course ☺)


Heuristic or randomised algorithms (e.g., RANSAC and variants)
What is in the middle here?
Globally optimal algorithms
Very fast (usually)
Very slow
No guarantees
Optimal
Random behaviour
Deterministic


Influence based CVPR2021,2022
Influence based quantum ACCV2020, ECCV2024
(deep) RL CVPR2021
A* search CVPR2015
Hypergraph vertex cover quantum CVPR2022
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by T.-J. Chin
Mathematical Programming Approaches, RANSAC in 2020.

And ideas/"discoveries" that haven't yet made it into publications (much less software…)

Hypergraph classes – structuring data complexity

- ultimately telling us "is MaxCon fitting of Fundamental Matrices provably harder than fitting a line in 2D and what are the nuances around that…what is the inherent structure of the data/problem"

- new algorithms….

THANK YOU and hope at least some of this has been interesting/will be useful in your future career!