Log : 10/18 - Current

January 30, 2021

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1.1 Differential Geometry

`https://en.wikipedia.org/wiki/Riemannian_connection_on_a_surface`

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2.1 Automated Theorem Proving

2.1.1 Open Logic

`http://builds.openlogicproject.org/`

Covers set theory, modal logic, model theory, computation, intuitionist models

2.1.2 Lean

`https://github.com/leanprover-community/mathematics_in_lean`

Tutorial:

`https://github.com/leanprover-community/mathematics_in_lean`

Background 1. Formal language setting: Dependent type theory

Question 1. What does ← do

Answer 1. Applies reverse rule(elimation rule). Like ← mul_assoc looks for a + (c + d) to turn into a + c +d instead of other way

Remark 1. Arguments to tactics are curried

Theme 1. Making mathematics more empirical/feedback oriented! Especially brilliant because it mirrors coding process so effectively.

Remark 2. Can rewrite any statement, assumption or goal

Prop 1. *apply tactic matches conclusion of theorem to goal and makes hypotheses new goal*

Prop 2. *exact tactic finishes proof with full apply(if given proof matches goal exactly)*

Remark 3. For working backwards

Question 2. Not really sure of difference between apply and exact

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3.1 Deep RL

`https://cmudeeprl.github.io/Spring202010403website/lectures/`

Idea 1. Using reinforcement learning in automated proof theory.

Prop 3. *In RL often cannot use gradient optimization, in contrast to supervised learning. So instead we use non-gradient optimization methods and gradient estimators*

Prop 4.

```
"it is comparatively easy to make computers
exhibit adult level performance on intelligence tests or
 playing checkers, and difficult or impossible to give them the skills
  of a one-year-old when it comes to perception and mobility"
```

Hans Moravec

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4.1 Northwestern Reserach

Transport Model for Feature Extraction

`https://arxiv.org/pdf/1910.14543.pdf`

Remark 4. Well known techniques for (nonlinear) feature extraction:

- Kernel PCA

- isomap
- locally linear embeddings
- laplacian eigenmaps

Def 1. Transport operator

$$Ty = Ly - div(vy)$$

for some anti-symmetric matrix v and laplacian L

On The Energy Landscape of Spherical Spin Glass : p-Spin

`https://arxiv.org/pdf/1702.08906.pdf`

4.2 Tensor Contraction

`https://www.quora.com/What-is`
`-Tensor-contraction-`
`How-to-compute-tensor-contraction`

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5.1 Set

Remark 5. Raw practice has allowed me to find sets quickly subconciously. Incoporating an algorithm to smooth out bias would be helpful.

For example I first always look for homochromatic sets. This induces a bias that I am then slow to fix. Explicitly looking for other pairs would help.

Cultivate useful habits(mental intuitions) and prune others.

Still important to identify characteristics with surplus

Good illutstration of the power of shifting perspectives and the necessity/efficiency of raw practice/intuition

Methods for identifying all diff: identify bottlenecks and work from those. Or raw search

Concious overhead corrupts subconciuos pattern recoginition(efficiency).

5.2 Chess

Remark 6. Don't make silly mistakes

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6.1 Variational Techniques in Stochastic Geometry

Remark 7. Looking at random variables on graphs

Def 2. U-stat : something nice

Def 3. $1_{0\to_{Z(\alpha)}}\partial B_n(0)$ is even we can raverse to boundary only on boolean occupied area

Remark 8. Goal is to control second order properties(variances).

Def 4. Mecke dormula encompes results for poisson process

Remark 9. OU semigroup: behaves differently on poisson vs. gaussian vs. hypercube measures. Is non hypercontractice ie. no log-sobolev

Remark 10. Charlize polynomials are orthogonal under poisson density

6.2 Chess

Remark 11. Want to compute faster somehow. Spend more time computign when it's not my turn. To compute efficiently think ADVERSARIALLY(what does my opponent want?)

Remark 12. Can't be tunnel visiond.

Remark 13. Don't mentally slack when ahead. Be ruthless

Remark 14. At least for now, while I'm developing intuition, mitigate unnecessary risks. Don't make moves that worsen my position

Remark 15. Don't worsen your position. Find tactics. Have a plan

Remark 16.

Remark 17. In response to he's been aggressive with sicilian and winning: Lately he's a little bit of a mirror. Showing your stupidity to opponents.

Remark 18. Tactics flow from superior position. Squeeze your opponent. Don't give opportunity for chances

Remark 19. Protect your king sufficietly. don't leave open to checks with tempo when attacking. Watch for poisoned pawns. Play for time when need be

Remark 20. Look for pawn fork tactics more. Higher level players seem to make much better use of pawns, as attackings

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7.1 Chess

Remark 21. Need to sometimes be constrictor like, not greedy in endgame with pawns. In general endgame is very scary, want to work on. See

`https://www.chess.com/a/QuDi3FgiXAX8`

Remark 22. Don't lose the game in your desire to win.

`https://www.chess.com/a/2YpuPr2bxXAX8`

Remark 23. Endgame principles: Keep king closer to pawn mass than opponents. Get pawns as far forward as possible

Remark 24. Calculate things through. Most people really have no idea what they're doing and just go through hoping it works

Remark 25. When I don't feel like being profalactic play aggressively. When I do play wel

Remark 26. If I'm feeling lazy, simplify and try to play conservatively. Be somewhat aggressive but not comittally

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8.1 Goals

1. 1400 chess
2. 3 pages of thesis
3. work on research

8.2 Chess

Remark 27. Getting a pawn down its file to pressure opposing king extremely powerful.

`https://www.youtube.com/watch?v=cevjjS9w0vM`

Giri converts to a miraculous win against dominant bishop

Remark 28. Principles of least effort chess(and in general least effort whatever). Key is to put in minimal effort/reps while still getting benefit/preventing burnout. Do as much as I can with as little exposure

Tactic/improve chess. Keep improving while taking advantage of tactics when possible. Easier to not think about grand strategy. When possible incorporate strategy. Prevent positional corruption until conversion

Remark 29. When finding a tactic always look for the counterplay.

Remark 30. Example of punishing aggressive queen: Great tradeoff positionally for less material:

`https://www.chess.com/a/357WvmXNEXAX8`

Remark 31. Losses are opporunities for learning/improvement. Review carefully and try again. Example: Note how I could have continued my kingside attack but didn't:

`https://www.chess.com/a/2qqkNdNvJXAX8`

Remark 32. Devoretsky's endgame manual: reccomendation

Remark 33. If I can perform when I'm burned out then I should always be able to perform. Note: difference between burnout and imbalance(I do well when I'm feeling good. Key is to not let losing streak make me feel bad).

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9.1 Chess

Remark 34. Want instincts to align with best practice. Especially in tactics trainer. Reduces need for computation. Also improve computation speed.

Remark 35. Don't give value to opponents pieces useless pieces.

Example 1. Back and forth game between Giri and Firouzja Tata Steel 2021:

`https://www.youtube.com/watch?v=0H9QLP5giAA`