Complexity Theory

Schrodinger 1

Zurek 2

Lloyd & Pagels 3

Bennett 4

Crutchfield 5

Wagner: evolvability 6

Information Theory

Shannon 7

McGill: Multivariate Info 8

Bell: Coinformation Lattice 9

Watanabe: multivariate total correlation 10

Thermo & Information

Thermodynamics of information review 11

Landauer: Information is Physical 12

Sagawa: Jarz with Info Feedback 13

Sagawa: thermo and logical work 14

Jarz: Exponential averaging 15

Partial Information Decomposition

W&B: Original PID proposal 16

Harder: Identity axiom proposal 17

Crutchfield: irrev persp 18, triadic v diadic 19, review incld mech rdn & shit proposal 20

Griffith: Review & syn proposal 21

Finn & Lizier 22

Bertschinger & Rauh proposals 23,24

Bertschinger & Rauh review 25

Will form 2 reports: 1 bio, 1 info

General overview form: context, problem, proposal, evidence, future works.

Each min 6 pgs, max 8 pgs, incld biblio, not incld appendix. Use latex.

Expand on the overview with additional focus on other proposals, ex’s, and evidence/images.

Pref fewer but more relevant citations

Target audience: less informed than a draft article

Then morph it into a presentation (~12min bio, 12min info)

Paper draft by June 12th, presentation draft by June 19th

Both finished by end of June, along with the internship.

1. Schrodinger, E. *What is Life? The Physical Aspect of the Living Cell*. (Cambridge University Press, 1943).

2. Zurek, W. Thermodynamic cost of computation, algorithmic complexity and the information metric. *Nature* **341**, (1989).

3. Lloyd, S. & Pagels, H. Complexity as Thermodynamic Depth. *Ann. Phys. (N. Y).* (1988).

4. Bennett, C. H. Logical Depth and Physical Complexity. 207–235 (1995). doi:10.1007/978-3-7091-6597-3\_8

5. Crutchfield, J. P. & Young, K. Inferring Statistical Complexity. *Phys. Rev. Lett.* **63**, (1989).

6. Wagner, G. P. & Altenberg, L. Perspective : Complex Adaptations and the Evolution of Evolvability. *Evolution (N. Y).* **50**, 967–976 (1996).

7. Shannon, C. E. A mathematical theory of communication. *Bell Syst. Tech. J.* **27**, 379–423 (1948).

8. Mcgill, J. Multivariate Information Transmission. *Trans. IRE Prof. Gr. Inf. Theory* **4**, 93–111 (1954).

9. Bell, A. J. The Co-Information Lattice. *Analysis* 921–926 (2003).

10. Watanabe, S. Information Theoretical Analysis of Multivariate Correlation. *IBM J.* (1960).

11. Parrondo, J. M. R., Horowitz, J. M. & Sagawa, T. Thermodynamics of information. *Nat. Phys.* **11**, 131–139 (2015).

12. Landauer, R. The physical nature of information. *Phys. Lett. Sect. A Gen. At. Solid State Phys.* **217**, 188–193 (1996).

13. Sagawa, T. & Ueda, M. Generalized Jarzynski equality under nonequilibrium feedback control. *Phys. Rev. Lett.* **104**, 1–4 (2010).

14. Sagawa, T. Thermodynamic and Logical Reversibilities Revisited. 3–8 (2013). doi:10.1088/1742-5468/2014/03/P03025

15. Jarzynski, C. A nonequilibrium equality for free energy differences. *Phys. Rev. Lett.* **78**, 0–3 (1996).

16. Williams, P. L. & Beer, R. D. Nonnegative Decomposition of Multivariate Information. 1–14 (2010).

17. Harder, M., Salge, C. & Polani, D. Bivariate measure of redundant information. *Phys. Rev. E - Stat. Nonlinear, Soft Matter Phys.* **87**, (2013).

18. James, R. G., Emenheiser, J. & Crutchfield, J. P. A Perspective on Unique Information: Directionality, Intuitions, and Secret Key Agreement. (2018).

19. James, R. G. & Crutchfield, J. P. Multivariate Dependence Beyond Shannon Information. (2016).

20. James, R. G., Emenheiser, J. & Crutchfield, J. P. Unique information via dependency constraints. *J. Phys. A Math. Theor.* **52**, 1–15 (2019).

21. Griffith, V. & Koch, C. Quantifying synergistic mutual information. (2012).

22. Finn, C. & Lizier, J. T. Pointwise partial information decomposition using the specificity and ambiguity lattices. *Entropy* **20**, 1–36 (2018).

23. Bertschinger, N., Rauh, J., Olbrich, E., Jost, J. & Ay, N. Quantifying unique information. *Entropy* **16**, 2161–2183 (2014).

24. Rauh, J., Bertschinger, N., Olbrich, E. & Jost, J. Reconsidering unique information: Towards a multivariate information decomposition. *IEEE Int. Symp. Inf. Theory - Proc.* 2232–2236 (2014). doi:10.1109/ISIT.2014.6875230

25. Bertschinger, N., Rauh, J., Olbrich, E. & Jost, J. Shared Information—New Insights and Problems in Decomposing Information in Complex Systems (from Proceedings of the European Conference on Complex Systems 2012). 591–606 (2013). doi:10.1007/978-3-319-00395-5