Research Statement

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1 Complex Systems

Many systems around us have a tendency to be greater than the sum of their parts. Simple interactions between these systems cascade their complexity beautifully to give rise to whatever we see.

In my study of biological systems from the cellular to ecological level, in the physical sciences from the quantum to the cosmological scales, in the social sciences from the psychology of individuals and the question of language to sociological dynamics at large, and even the emergent complexity of neural networks and how they mirror our brains, I keep coming upon this dynamical interplay of structure and chaos.

This same movement has been echoed by a lot of the giants whose shoulders I stand on, be it in the realm of philosophy and metaphysics or analytical reasoning. These phenomena, especially how they relate to the nature of our consciousness have an endless capacity to make me curious.

I am interested in both philosophical and mathematical approaches to these questions. I think advances in either complement our understanding of the other and the distinctions we make between these fields are ultimately illusory and hence should be transcended if it helps get a better picture.

2 Topics of Interest

2.1 Semantics of Computation, Vector Grounding

- Compute is Increasing, so much of it is Neural Networks.Whiteboxing these neural networks, what do the vector weights of the features mean?

- Possible relations to ethical implications of training of datasets.

- More interested in how this connects to the Nominalism vs Universals in Linguistics. Interested in exploring symbolic dynamics to model this and psychoanalytic/philosophical frameworks of mind also Buddhist approaches.

- **Social Implications** Interested in modeling the effects of these technologies upon us in a Heideggerean Sense and also in the sense of the French critical media theorists.

2.2 Unified Mathematical Formalisms for Emergent Complexity at different scales

I am deeply captivated by the beauty of mathematical concepts that have the power of generality. I feel that they are powerful, and the more we zoom out and abstract out processes that are more general, the more it allows us to also see the beauty in the particular processes that make an instance of the process fully manifested. This has prompted me to explore category theory, and random dynamical systems independently from my course curriculum.

Based on my knowledge, I am in the power of category theory as a formalism to express emergent complexity at different scales because of how it deals with relations between objects instead of particular objects themselves.

I have also been impressed by the power of Hamilton's least action principle and the application of similar optimization-based models to different fields. The methods of statistical mechanics are similarly powerful.

Finding physical realizations of abstract mathematical concepts derived from one aspect is a fun and engaging puzzle for me.

2.3 Hard Problem of Consciousness and Paradigms of Scientific Thinking

- Does the hard problem really exist

- Analytical Frameworks such as Bernardo Kastrup's

- Relation to Eastern Theologies like Advaita and Buddhism which I have been interested in for a long time.

- **Social Implications**-Interested also in perspectives on decoloniality, or modeling belief spread- why did these die out.

- This tells us about the 'stuckness' of our scientific paradigms, but again different models are required to demonstrate that through an internal critique