

23<sup>rd</sup> April 2020

Dear Editor in Chief (Dr Sarah Callaghan),

I write to you alongside the submission of the manuscript titled "A Natural Representation of Functions that Facilitates 'Exact Learning'" to Cell Press: Patterns. I was very excited to hear about the launch of your journal at the AI3SD Network+ Conference and subsequent reminder at the Royal Society of Chemistry. The work I have submitted for consideration fits well with the scope and requirements of your journal, especially along the vein of interdisciplinary methods and tools developments.

This is a theoretical piece of work, which attempts to lay the mathematical concepts and foundations for new machine learning and data methods which could reverse engineer an *exact* functional form from numeric data without resorting to approximations, or polynomial fitting, or the large number of parameters seen in contemporary machine learning methods. The practical application of this would be to collect data from a statistical source or numeric solution of physical problem where it is hard to solve for the solution mathematically. Following this, one applies the algorithm and it will suggest an exact form for the data. For example, if I numerically solve the Schrodinger equation for a tricky (high dimensional) potential, the algorithm can search analytic function space for an answer that matches the numeric solution.

The representation used appears to be quite fundamental, and future developments using this method should prove fruitful. In the long run I hope that this method could be used to make discoveries in mathematical science where equations are hard to solve, but data are easy to collect and in principle analytic solutions to problems could exist.

There is one administrative issue I should be upfront about. Upon preparing the documents for submission I noticed that the journal asks for a publication fee of \$5,200. I can completely understand this requirement as you are making all of the work open access which is commendable. As I have transitioned from a full-time student to only a *visiting* researcher at the University of Cambridge, I have no means to pay the fee as I do not have research funding of my own. I am happy to ask the University open access service to pay if the manuscript makes it through the review process, I have negotiated with them in the past. However, if for some reason they refuse to pay I would not have any other options and hope it would be possible to waive the fee.

I hope that the manuscript can be considered for publication in Patterns and look forward to hearing back from you.

Yours sincerely,

Dr Benedict Irwin