Polymer based neural network for molecular computing, 15 May 1991

Ian Pearson, Futurologist

Reading this in 2009, it looks very half baked but with a little untapped potential. The basic idea at the time was trying to tap in to the need for a faster processing matrix than was offered by digital processors – I had spent a little time with an analog computer before it was dismantled in the early 80s and was very frustrated at the sluggishness of digital processing. I still think some of this idea would work, especially when linked with my later concept of software transforms. With the simulation capacity now available in the proteomics field, to design and simulate protein molecules, it could be that this idea's time will come soon and we will be able to fabricate ultra-high speed neural networks directly in polymers, with superhuman processing capability. Anyway, here is the idea as it was then:

Neural Networks Memo

I D Pearson, 15/5/91

Introduction

Current neural networks are implemented either in simulation or directly in silicon. Neither of these approaches is likely to allow them to reach their full potential. Alternative mechanisms in research also concentrate on the optical domain, using holographic mechanisms to produce SLMs etc, thus giving an optical weighting mechanisms.

I have not yet seen any papers on other approaches, but it seems obvious that biological and organic chemistry approaches should offer some potential. With current hostility towards genetic engineering, perhaps a pure biological approach may be some time off. However, the field of plastics is continuing to offer novel materials in many areas.

All (current) plastic materials are essentially carbon chain based, with various radicals attached to the carbon bonds. The properties of these radicals contributes to the structure and properties of the final polymer materials. In particular, some plastics have been made which have good electrical properties. It is conceivable that plastics could be invented which could have properties useful in neural network design.

Polymeric Solution

Neural networks produce an output from a node by processing several inputs (usually in a simple weighting operation). It should be possible to build a solid matrix of appropriate electromagnetically interactive polymer which would provide a homogeneous structure with

interactions between the various radicals in all (or selected) directions. The result would be a truly molecular neural network. Presumably matrix design would allow different processes to be emulated and thus give a range of different functions. Careful design of the polymers could produce the desired weighting functions.

It is not obvious whether this mechanism would be feasible, there are a few questions which need studied. Mainly, would the weighting factors be fixed for all time or would it be possible to program the matrix dynamically? Also, even though an input to the matrix may produce a set of interactions, how would the output from the matrix be obtained?

I believe this area is one worth study, since the benefits in speed and cost obtained by molecular level processing could be very large.