Workshop on Computational Intelligence

IEEE Computational Intelligence San Diego Chapter

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Location:
Advanced Test Equipment Rentals
10401 Roselle Street
San Diego, California
Choice of topic

I wanted to use tonight to discuss some interesting lemmas that I had worked on as a graduate student in computer science.

\[
D/2 \left[ \sum_{X} \sum_{i} \sum_{Y \neq X} d_{XY}V_{Xi}(V_{(Y, i+1)} + V_{(Y, i-1)}) \right] \\
\]

The coefficient \( D \) is of course a scaling coefficient. The energy function for the network is the sum of eq. (9.8), eq. (9.9), eq. (9.10), and eq. (9.11). We show the whole formula below:

\[
E = A/2 \sum_{X} \sum_{i} \sum_{j \neq i} V_{Xi}V_{Xj} + B/2 \sum_{X} \sum_{i} \sum_{Y \neq X} V_{Xi}V_{Yi} + C/2 \left[ \left( \sum_{X} \sum_{i} V_{Xi} \right) - m \right]^2 + \]

\[
D/2 \left[ \sum_{X} \sum_{i} \sum_{Y \neq X} d_{XY}V_{Xi}(V_{(Y, i+1)} + V_{(Y, i-1)}) \right] \\
\]

(9.11)

(9.12)

The quadratic terms of eq. (9.12) relate to the connection strengths, and the linear terms contribute to the threshold values. The goal is a form recognizable as the total energy equation of eq. (9.5) so that we can extract thresholds and connection strengths directly. All but one of the terms of eq. (9.12) sum over \( X \) and \( i \), so we can reorganize eq. (9.12) into the following equivalent form:

\[
E = 1/2 \sum_{X} \sum_{i} V_{Xi} \left[ \sum_{j \neq i} AV_{Xj} + \sum_{Y \neq X} BV_{Yi} + \sum_{X} \sum_{i} C + \sum_{Y \neq X} Dd_{XY}(V_{(Y, i+1)} + V_{(Y, i-1)}) - 2Cm \right] + \]

(9.12)
I wanted to use tonight to discuss some interesting lemmas that I had worked on as a graduate student in computer science... But then I thought better of that...

There is one person you can thank for this reprieve...
Professor Joseph Lewis introduced me to the concept of “embodied cognition”. That is...

An artificial system doesn't qualify as intelligent because it proves theorems or wins at chess. An artificial system qualifies as intelligent if it can successfully interact and adapt its behavior to survive in the real world.

The goal of an embodied system is to produce ongoing behavior

...And he introduced me to Tom Sgouros.
Judy, or what is it *like* to be a Robot

- Tom asks: “if we could build a robot intelligent enough to do the dishes, would it also find that task boring?”

- What does it mean to “upgrade” such an entity? Judy asks: “will I still be Judy?”

- Do we share context for communication. Tom asks Judy “what is it like to be a robot?” Judy doesn’t know how to answer. “What is it *like*” depends on shared frame of reference.

Tom Sgouros and Judy the Robot in *Judy, or what is it like to be a Robot?* Circa 2003
Judy's descendants share space with us

What are the consequences of sharing and competing for the same scarce resources with self-aware non-biological entities?
We share space with Judy's descendants

What are the consequences of sharing and competing for the same scarce resources with self-aware non-biological entities?
Meanwhile, back on the planet of the math people...

Geoffrey Hinton, Yan Lecun and others continued to work on very competent networks that lived apart from us on big computers

...bigger and bigger computers...

...until the computers got so big that they spanned the globe...

...they really didn't compete for scarce resources with the organics...

...except that they needed the data that the organics produced...

...lots of it!!!
It's super smart! You need it. But you can't know how it works.

Any product that excites you over the next five years and makes you think “that was magic! How did they do that?” is probably based on [Deep Learning].

Can we design systems that exceed human intelligence by traditional human design methods? I don't think we can. … [a neural networks is] an inscrutable black box. You can only understand its process of creation and the interfaces used to generate it ... [It is] an iterative algorithm that generates really powerful designs many of which are patentable and exceed human capabilities. But there is no way to shortcut complexity; no way to reverse engineer. You end up with a black box defined by its interfaces. You don't tweak the product you tweak the process.
...Or even what it knows

Several different machines learned the same concept, and performed nearly identically on a validation data set...

...But apparently they learned very different things...

What if this was an embodied (behavior producing) system rather than a classifier?

Wolfram Research, 2015
Geoff and Judy got together and had a baby. She's named the IoT.

Each of us now wears more computational power and more processors than major cities had in 1955.

And each of those processors is connected to our world on one end and to Planet Math on the other.

Wearable computing, BTW, is only a tiny slice of the Internet of Things.
When Judy's baby grows up, she's going to want to play

At a recent Knowledge Day at Cymer, Joseph Sirosh, Microsoft’s head of Machine Learning, noted that in about 2014, Big Data transformed from batch-oriented answers to questions about “what happened?” to stream-oriented decision and control.

“Closing the loop” as he described it.

Closing the loop means that she operates across the cloud through effectors on our world. We share the same scarce resources with her.

http://www.ersatzlabs.com/
Some questions to ponder about living together in harmony

- What does “self-awareness” mean for non-biological entities?

- Is it silly to build our synthetic friends with a “Fail Safe”?

- What is our role when we share the environment with synthetic entities more competent than us at intellectual tasks like medicine, math, driving?

- If a corporation is a person, is Judy a person too?