Back to the Future: Surrogates, Mirror Worlds, and Parallel Universes

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Happy New Year!

I had planned to finish this letter first by Christmas Eve, then by New Year's Eve. However, urgent work came up, and I ended up spending two sleepless nights. So, my New Year's Resolution was no more all-nighters and completing work as planned. These seemed to be impossible goals until I recalled a recent in-flight movie, *Surrogate*. I immediately revised my resolutions: buy a surrogate.

Surrogate

The movie, while not necessarily artistically impressive, explored the intriguing idea of a world where remote-control surrogate robots assume societal roles for humans. Although the actual possibility of such humanoid creations is a long way off—the advanced technology required will probably not appear in my lifetime—a cyber counterpart is much more realistic. Creating such counterparts could be a valuable research and development direction for those interested in this magazine. We could create "software surrogates" that perform our tasks for us within cyberspace—crawling beneath the Internet—gathering information, organizing our life, improving our studies, and conducting our business. Ultimately, these software surrogates will enhance our abilities and make our lives and societies safer and more effective, leading to a "smart world."

We are well on the road to such a reality. Early last November at the Los Angeles International Airport, I picked up an issue of *The Economist*, which included a special report on smart systems. The report discussed the convergence of real and virtual worlds, detailing current advancements in sensor technology, communication, social networking, and many other topics related to our research field. I encourage everyone to pick up the issue for themselves.

Mirror Worlds

The special report mentioned the book *Mirror Worlds: Or the Day Software Puts the Universe in a Shoebox … How it Will Happen and What it Will Mean* by David Gelernter (Oxford Univ. Press, 1993). I came across this book while staying at the Kavli Royal Society International Center in Buckinghamshire last September and October. Sitting beside the beautiful Kavli ponds, I could not tell the difference between the real trees lining the bank and their perfect reflections, mirrors in the water. It was the perfect place to read Gelernter's work.

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Gelernter envisions a future where every aspect, every reality of our world is reflected within software programs, where we interact with our world through computer screens. Although I knew of Gelernter because of his attack by the Unabomber, I had never read this book before. I wish I had read it earlier! The seminal concepts in his book implied many of the possibilities and directions in intelligent systems we are now approaching. My own concept of the ACP approach (artificial societies for modeling, computational experiments for analysis, and parallel execution for control) for complex and intelligent systems is similar in spirit to many of his ideas. Actually, I have urged people in many cases to create information machines that (like their industrial precursors) would manufacture products using collected data and information, a concept also discussed in *Mirror Worlds*.

However, Gelernter did not simply theorize; he helped found a company, Mirror Worlds Technologies, which produced Scopeware software based on the ideas outlined in his book. Unfortunately, it seems the company was not very successful and, in 2008, filed suit against Apple for patent infringement. Late last year, a jury awarded Mirror Worlds US$625.5 million in damages. If the verdict is allowed to stand, it would be the fourth-biggest patent verdict in US history.

In researching and contemplating Gelernter's book and company, I found myself wishing that his commercial adventure had been as successful as Google or Facebook. If it had, then a myriad of intelligent enterprises, as I discussed in the inaugural issue of our Cyber-Physical Social Systems (CPSS) Department, would be in full bloom today.

Parallel Universes

Sometimes coincidences are ordinary, but my stay at the Kavli Center was a string of extraordinary coincidences. I was staying in a room named after Nobel Laureate physicist S. Chandrasekhar. Years ago, my colleague Dr. Fan, one of his former Chinese students, gave me four of Chandra's chairs as a keepsake. It was on these chairs that Fan and two other Chinese students had often sat while learning from and discussing with the professor; two of them, Drs. Lee and Yang, went on to win Nobel prizes themselves. So, my stay in Chandra's room was a particularly nice surprise.

Another fluke was an issue of *New Scientist* in my room, featuring an article on a new mathematical interpretation of Hugh Everett's parallel universes. It occurred to me as I was reading Gelernter's book that mirror worlds were projections of parallel universes in cyberspace! It felt like a lot of coincidences at once, and the moment felt surreal and the possibility of "an infinite space containing infinite copies of our Earth" did not seem so absurd.

My own ACP approach was originally inspired by the concept of parallel universes; now Gelernter's mirror worlds are more like the software version of Everett's multiverses, in cyberspace. In a universe with mirror worlds, the scenarios explored in movies such as *Back to the Future* and *Inception* could be very real and simple—just backtrack executed instructions and reprogram the event.

Figure 1. IEEE Review Panel. Editor-in-Chief Fei-Yue Wang, IEEE Computer Society Vice President for Publications David A. Grier (far right), and the rest of the panel found *IEEE Intelligent Systems* to be in great shape.

For now, back to the reality: with this issue I present to you the AI's 10 to Watch list. Congratulations to everyone on the list, and I wish them continued success and progress in their research and development. Due to space limits, our winners for the IS Hall of Fame will be announced in a future issue.

In addition, my visit last November to New Jersey for the five-year review of our magazine was a real pleasure. The panel considered our magazine in great shape, and the review results were excellent (see Figure 1).

Last but not least, I would like to welcome Daniel Zeng as a new associate editor in chief and thank him for all of his hard work and great service for our magazine.

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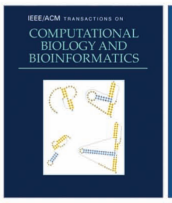

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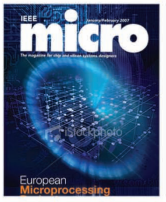

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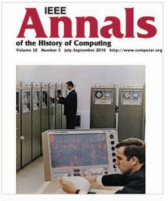

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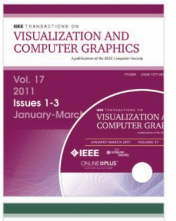

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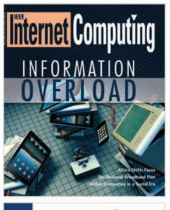

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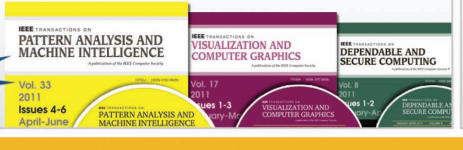

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