INIT

Neuroscience and Computing

Did you know that when you look at pictures of babies before you brainstorm, you are more likely come up with creative ideas?

Your brain is a wonderful and powerful thing—inundated by neurons, saturated with synapses, and engrained with you. It is intricately involved with everything you do and everything that makes you who you are. It is also complicated and complex in a way that has intrigued and mystified philosophers, psychologists, physicians for centuries. But the brain is no longer exclusive to neuroscience.

Emerging brain-sensing technology has allowed the curiosities of the brain to drift into the world of interfaces and algorithms. As the interests of computer scientists gravitate toward the brain, entirely new questions emerge. Can we monitor the brain while writing a paper, playing a game, or performing a musical piece? Can we study how the brain learns and use it to influence and improve our own algorithms? Can we create computer applications that are attentive to our situational cognitive needs?

As we learn more about the dark corners of the brain, we learn more about the way we interact with the world, and more about how we can design a world to more naturally interact with us. In this issue, we highlight researchers that are dedicated to examining the brain, learning from the brain, and building programs that are driven by the brain.

SEEING THE BRAIN

Kicking things off, Amelio Vazques-Reina, Won-Ki Jeong, Jeff Lichtman, and Hanspeter Pfister bring us into a world of exploring and visualizing the complexity of the human brain. With 100 billion neurons, how can we even begin to see and understand it?

We also had the opportunity to profile Ed Boyden of the Synthetic Neurobiology Group at the MIT Media Lab. He is quite literally illuminating the brain—the group addresses the challenge of analyzing and engineering brain function by activating or silencing neural circuits with light.

THE BRAIN AND THE COMPUTER

We move from examining neurons and synapses to brain-computer interfaces (BCI). We polled researchers and research labs from across the globe that are experimenting with commercial brain sensing equipment for real-world scenarios, monitoring and leveraging the signals of the brain as people go about their everyday life. We ask (and they answer) about lightweight brain sensors, the advantages and concerns of easy to use sensors, and about their potential applications.

Of course, with the potential of BCIs also comes a backlash. Brendan Allison describes in detail the remarkable advances in signal acquisition, signal processing, applications, and application interfaces that have pushed BCIs into the spotlight. However, he also warns about diluting terminology, cautions about overly optimistic claims, and wonders about the consequences of unwarranted expectations from the media. It's a sobering, but necessary, perspective of the dangers that often lurk beside a new and exciting field.

Next, Ryan Kelly describes the side of the brain we don't notice—processes that sit behind our conscious mind, but still influence our behavior and interactions. What types of ethical concerns arise when we begin to nudge users through subliminal interactions? Can we leverage these subtle interactions into positive outcomes?

LESSONS FROM THE BRAIN

Finally, Jonathan Laserson interviews Andrew Ng and Jeff Hawkins about "Deep Learning"—an entirely new approach to artificial intelligence that is based on the way the brain processes information. Their discussion about using our understanding of the brain to build better algorithms gives a refreshing perspective on the potential of machine learning and artificial intelligence.

We are excited to step aside and let you interact with this collection of researchers who are breaking ground in the multiple fields that their work straddles. They are designers, engineers, psychologists, and computer scientists, and their unique perspectives offer snapshots of the brain that until recently, lived exclusively in science fiction novels. We hope this issue pushes you to think about the many facets of brain research—about its potential, about its obstacles, and even about its dangers. But most of all, we hope you enjoy reading.

—Evan M. Peck and
Erin T. Solovey,
Issue Editors