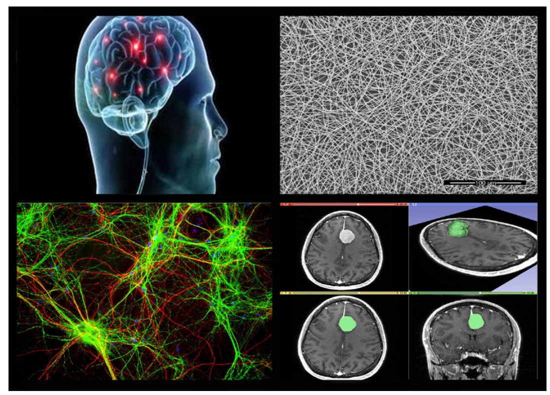
Neural Network that Features Sparse Memristive Connections

New Architecture Derived from Electrospun Fibers and CMOS-Based Neurons Better Imitates the Human Brain



This neuromorphic hardware architecture is a neural network that models biological brains by implementing sparse memristive connections but without the limitations current architectures impose. This idea proposes a memristive architecture composed of electrospun nanofibers and conventional complementary metal-oxide-semiconductor-based neurons. The neural network would learn like the brain in that connections between some neurons would grow and learn while others are weakened. Current memristive neural networks use a crossbar architecture; however, the neurons are connected in an inefficient manner with poor scaling properties. University of Florida researchers propose a memristive network that would embrace variability in memristor processing and imitate the brain more closely. The proposed architecture would possess applications in a number of fields, including computer vision, fraud detection, diagnostics and modeling, pattern detection and data analysis, and marketing trends.

Application

Flexible 3D neural network that learns like the human brain

Advantages

- Uses sparse memristive architecture, producing a network that learns like brain
- Allows recurrent connections between neurons, embracing random variation like biological systems
- Permits competitive outputs, allowing passive learning that doesn't require algorithm
- Utilizes electrospinning, providing facile manufacturing

Technology

The neural network proposes a new architecture that would provide several advantages over the currently used memristor crossbar architecture. This architecture uses sparse coding and sparse connectivity to link neurons with modifiable synapses. It uses an array of CMOS Integrate-and-Fire neurons randomly connected by a network of electrospun nanofibers. The nanofibers would act as memristive connections between the CMOS-based neurons, allowing properties such as random, spatially dependent connections, competitive outputs, and recurrent connections. The nanofibers would have a conductive core that accepts input until it reaches a limit, and then fires the output. No algorithm is needed to make the network learn.

The Inventors

Juan Nino, Ph.D., is a Professor in the Materials Science and Engineering Department at the University of Florida, where he focuses on the development of advanced functional materials for energy-related applications. He has more than 100 peer-reviewed journal publications in the field of materials. Dr. Nino is the Associate Editor of the Journal of American Ceramic Society and is a 2014 U.S. Fulbright Scholar.

Jack Kendall is an undergraduate student at the University of Florida pursuing his degree in Chemical Engineering and Physics. He is a member of the Nino Research Group.

About the Office of Technology Licensing

The amount and diversity of research taking place at the University of Florida generates an average of 300 new discoveries every year. The successful commercialization of these discoveries requires considerable time, effort and resources, and is dependent upon partnerships with commercial entities. During the three decades since the landmark Bayh-Dole Act of 1980 authorized and encouraged universities to commercialize their discoveries, the University of Florida has become a national leader in moving faculty research into the marketplace. Since its inception, the University of Florida Office of Technology Licensing (OTL) has helped to transfer hundreds of technologies from university laboratories to private industry. Noteworthy examples include the famous sports drink Gatorade®, the glaucoma drug Trusopt®, and the termite-colony elimination system Sentricon®. By helping to move technologies out of the laboratory and into the marketplace, OTL helps the university achieve its mission of transferring knowledge for society's benefit while improving the lives of people around the world. We pride ourselves in our reputation as a leader in commercializing discoveries that are curing diseases and making the world a better place.

Contact:
Lenny Terry • (352) 392-8929 • lterry@ufl.edu
UF #15244 • Patents Pending