

Columbia University, Flywheel and Google team to create a cloud-based MRI Research Center

Columbia University's Magnetic Resonance Research Center will connect five New York City biomedical imaging facilities to share data in order to advance basic and translational research.

Dr. Thomas Vaughan and his colleagues at Columbia are creating a scalable network of distributed research and diagnostics nodes to improve efficiency and scientific collaboration. Collecting, storing, and processing biomedical data in Google Cloud Platform (GCP), in coordination with (Flywheel's) [https://flywheel.io] innovative biomedical informatics platform, offers the potential for increasing accessibility, such as linking large networks of remotely located points-of-care via satellite. One day, magnetic resonance imaging could reach and serve global populations that are currently beyond reach.

As Professor of Biomedical Engineering, Radiology, and Applied Physics at Columbia University, and a principal investigator at Columbia's [Mortimer B. Zuckerman Mind Brain Behavior Institute](#), Vaughan has been a pioneer in developing advanced magnetic resonance imaging (MRI) systems and applications for biomedical research and diagnostics. He is currently heading the Columbia Magnetic Resonance Research Center (CMRRC) by connecting five Center nodes—Columbia's Zuckerman Institute, Columbia University Irving Medical Center, Columbia's School of Engineering and Applied Sciences, the Nathan Kline Institute for Psychiatric Research, and the New York State Psychiatric Institute—to make the CMRRC the first MRI research center in the world to automatically collect, process, share, and store all data in the cloud. Vaughan and his team are also working with delegations in China, India, and with other collaborators around the world to explore whether this model of efficient, cost-effective research and diagnostics can be expanded on a global scale.

MR Imaging (MRI), MR Spectroscopy (MRS), and functional MRI (fMRI) are powerful tools for non-invasive acquisition of high-resolution and high-contrast structural, metabolic, and physiological data for research and diagnostics of the human body in health, disease, and therapeutic intervention. Unlike complementary imaging modalities using ionizing radiation (CT), MRI can be used to acquire images safely over the lifetime of a patient or volunteer. According to the World Health Organization, however, 90% of the world does not have access to MR systems or their diagnostics benefit. By centralizing talent and technology resources into a central hub and extending this resource support to multiple, minimally staffed and equipped points-of-care, experts argue that the cost, inefficiencies, and redundancies of healthcare diagnostics and scientific data collection can be conserved. The tools harnessed here by Vaughan and his colleagues represent an important step toward that vision.

In the future, Vaughan says, “we could conceivably collect data from infancy on. We could provide point-of-care diagnostics. We could scale this to the size of the planet. That's where we want to get to. Not just with the cloud and technology, but with overall diagnostics and therapy.” He believes that collecting more data from more diverse populations and processing those datasets more efficiently will improve patient care and accelerate biomedical research.



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Dr. John Thomas Vaughan, Director of the Columbia Magnetic Resonance Research Center and Professor of Biomedical Engineering, Radiology, and Applied Physics, Columbia University

Scaling data and computing from one institution to five, from three MRI machines to sixteen

In 2017, Columbia's Zuckerman Institute partnered with Flywheel to install the company's collaborative medical imaging platform locally. MRI machines produce three-dimensional, high-resolution images that can be further post-processed for diagnostic presentation. For MRI researchers, Flywheel's scalable research platform integrates, manages, processes, and shares imaging data in a reproducible, efficient manner. In addition to connecting the different labs of the CMRRC, Vaughan and his colleagues at neighboring institutions are exploring a greater New York network integrated in the same manner and, eventually, to researchers around the world.

For their cloud-based integration, data management, and operations, Flywheel and Vaughan chose Google Cloud. For Vaughan, “Google's emphasis on security was very important.” Private health information is strictly regulated, and Google Cloud and Flywheel are fully compliant with federal and institutional requirements to anonymize and safeguard that information in long-term archives. According to Can Akgun, Director of Business Development at Flywheel, the transition from an on-premises installation of Flywheel to GCP required a week of testing before they were operational. Now Zuckerman Institute researchers can use the Google Compute Engine to advance their research from basic scripting to complex machine-learning algorithms. “With the Flywheel deployment on GCP” Akgun reports, “researchers at Columbia have access to unprecedented computational power to process their data and visualize their results. They now have nearly unlimited data storage and computational power at their convenience.”

Connecting the world's biomedical data

In the longer term, Vaughan hopes to scale the CMRRC model of distributed points-of-care connected to cloud-based diagnostic and research resources to create a national and global network of clinics and laboratories. “To become a truly distributed research center, we want to extend our lab to the world—connectivity and cloud storage help us to do that,” Vaughan argues. “They represent an important platform for more comprehensively and effectively observing and investigating our world.”



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Can Akgun, Ph.D., Director of Business Development, Flywheel

ORGANIZATION PROFILE

Founded as King's College in 1754, Columbia University is one of the oldest universities in the United States. As part of an ambitious expansion, in 2017 it opened the Jerome L. Greene Science Center in Manhattanville. The home to Columbia's Mortimer B. Zuckerman Mind Brain Behavior Institute, the Greene Science Center serves as a hub for pioneering scientific research that spans academic disciplines.

PRODUCTS USED

[Google Cloud Platform](#), [Compute Engine](#)