

## **The GeoBrain system: equipping students' brains with the capability for geospatial thinking**

Liping Di, George Mason University, Fairfax, VA

*An Earth system science learning and research environment made possible by a geospatial information and knowledge system based on Web services.*



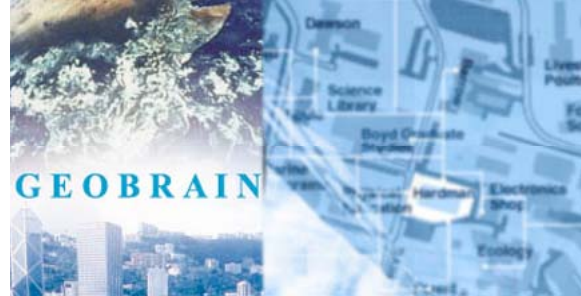
As an international student, Jian Huang felt fortunate when he was awarded financial support as a Graduate Assistant in the School of Social Science at the University of Texas at Dallas (UT Dallas). This financial support meant a great deal to him, in that the benefit was more than just the provision of a regular income. Much of its appeal came in the form of a waiver for expensive out-of-state tuition and fees. Now Jian is confident that his dream of completing his graduate study in the U. S. can be realized without having to worry about financial constraints.

The award of financial support was based primarily on Jian's outstanding performance in the study of Geospatial Information Sciences (GIS), which he credits mainly to the availability at UT Dallas of a newly developed online system called GeoBrain. GeoBrain is an Earth system science (ESS) learning and research environment made possible by a geospatial information and knowledge system based on Web services. GeoBrain has been developed by the NASA EOS Higher Education Alliance (NEHEA) led by George Mason University, through research grants from the NASA Earth Science Research, Education, and Applications Solution Network (REASoN) program. As a member of the development team of NEHEA, UT Dallas naturally became one of the earliest adopters of the GeoBrain system.

Like most graduate students studying GIS in the School of Social Science, Jian came from a background rather different from traditional geography. In the early stages of his graduate study, he found it challenging to understand the material about Earth systems. His undergraduate training in philosophy had endowed him with strong logical thinking skills, but primarily in a one-dimensional, sequential manner. The professor of his Introduction to GIS class, Ronald Briggs, often told students, "Comprehension of ESS usually requires the capability of geospatial thinking, a perspective that is often two dimensional and sometimes even three or more dimensional." Jian found making such a transition in his fundamental reasoning system difficult initially.

The situation improved second semester when he started to use the GeoBrain system in a Remote Sensing class taught by Fang Qiu, a co-PI of the GeoBrain project, who embraced the earlier versions of the system in his teaching. Via a web interface, students accessed satellite images and digital elevation models that had been collected by NASA's Earth Observing Systems. These current and historical digital data enabled students visually to investigate the changes in the environment and explore the underlying processes driving them.

For Jian, the maxim “Seeing is believing” was amended. For him, it is more that “Seeing a lot is understanding.” Through extensive visualization and analysis of the large amounts of geospatial data provided by the GeoBrain system, Jian says, “I finally feel like I can now easily form a map and even a virtual environment model in my mind when I need to comprehend the dynamics of the Earth system.”



For his course project, Jian studied the urban sprawl of the City of Dallas and its impacts on population growth. Through the geospatial data Web service of the GeoBrain system, he was able to obtain satellite images from different time periods. These images had been preprocessed by the GeoBrain system using the computational power of the NASA EOS data centers, with subsetting, resampling, reformatting, reprojection, and georectification. One of the best parts, says Jian, was that all the images were free—a great boon for any student. The changes in urban land use seen on the images enabled Jian to predict population growth accurately through a correlation analysis.

Successful in the course project, Jian went on to serve as a Teaching Assistant for the Remote Sensing class. Probably due to the adoption of the GeoBrain system, the Remote Sensing class has become so popular it over enrolls, meaning that there are no longer enough commercial software licenses to give every student access to the lab at the same time. Fortunately, the GeoBrain system not only provides customized data access capability, it also offers an online data analysis Web service that can process varied types of geospatial data. Qiu has now enlisted Jian to develop a Web interface for these GeoBrain geoprocessing tools, with the goal of giving more students access to the system—which Jian hopes will help them become successful geospatial thinkers like him.

GeoBrain

<http://geobrain.laits.gmu.edu/>