RESEARCH

Predicting geohazards

Associate Professor Dr Biswajeet Pradhan with his research students from around the world.

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IN the occurrence of natural disasters, numerous factors come into play which make the analysis of geohazards an always complex task.

In Universiti Putra Malaysia (UPM)'s Department of Civil Engineering, Associate Professor Dr Biswajeet Pradhan is one who always wanted to explore fascinating phenomena and willing to take up challenges in doing so.

The top researcher has chosen to further pursue his interest in the field of natural hazards with the aid of remote sensing and Geographical Information Systems (GIS).

"My research interests consist of two interrelated tracks: the spatial (statistical) model development for floods, landslides, debris flow, rock falls, oil spills, hot installations (industrial hazards), forest fires and earthquakes, and the computational modeling of hazard, vulnerability and risk analysis," he said.

"These two parallel paths share much in terms of underlying themes, but I tend to identify individual projects as belonging exclusively to one path or the other.

"This imposed separation facilitates the enumeration of project goals and the evaluation of project success."

Pradhan, now aged 41, had started his research back in 1999, when he was pursuing his Master of Technology (MTech) at Dresden University of Technology (TU-Dresden), Germany, with a full scholarship by German Academic Exchange Services.

"At TU-Dresden, I developed an interest in the field of remote sensing technologies and its applications in disaster modelling and natural resources management," he said.

Pradhan then earned his PhD degree in GIS and Geomatics Engineering from UPM, after which he made considerable progress in developing a new compression technique for three-dimensional terrain data compression using second generation wavelets.

"Besides my research in wavelets, I was leading numerous projects related to remote sensing and GIS based applications mostly in natural hazards," he said.

"This approach has grounded my work in reality, provided me with many critical insights and produced many important and high-impact results."

His impressive publication records in high-impact ISI journals led Pradhan to be selected for the two-year Alexander von Humboldt Fellowship to continue more fruitful research in Germany from 2008 to 2010. Since March 2015, he has also been serving as Ambassador Scientist for the Humboldt Foundation.

Pradhan is quick to point out that while conducting academic research has rarely been the easy option, UPM has a "one-stop Research Management Centre which encourages high-quality research work through grants, awards, incentives and the like."

It also helps that Pradhan finds research work to be "oddly fun, even if it involves a lot of effort, time and energy."

He said: "For me, managing time is a challenge because an associate professor will be engaged in various activities during the day.

"Self-discipline is the most important factor for a researcher to excel. Apart from that, a total support system from my wife Sheila and two sons whose understanding has played a very important role towards my success in finding time to do as much research that I do."

In UPM, Pradhan supervises a large group of more than 10 PhD students and numerous MSc students in their research.

In addition, besides TU-Dresden, Pradhan collaborates extensively on remote sensing and GIS research activities with many other well-established international institutions.

Said Pradhan: "With natural disasters constantly taking place, remote sensing and GIS on geohazards are gaining immensely in importance by the day.

"The development of a prediction model can create tremendous awareness among communities of potential victims.

"My research findings on geohazard susceptibility, vulnerability, risk modelling and forecasting can provide a basic platform for overall disaster management and mitigation.

"My research domain and expertise extend further on various aspects of utilising state-of-the-art information and communication technology for developing central disaster database with the priority given to data generated by Remote Sensing Technology and Geoinformation tools.

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Associate Professor Dr Biswajeet Pradhan

NATURAL HAZARDS WITH THE AID OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

WHAT — The development of aerial photogrammetry has made it possible to examine and quantify geohazards remotely by measurements from aerial photographs. Subsequent convergence of photogrammetry and digital imaging technology in recent years has led to increasing use of Digital Elevation Models in modern studies of landscape change.

HOW — Development of various GIS software used in conjunction with remote sensing has enabled experts to prepare maps and prediction models, while the ongoing revolution in geosciences and photogrammetry entails the creation of new methods. From the end of the last century, geosciences and photogrammetry have emerged among the most important engineering disciplines involved in developing new strategies in this field that can have a significant impact on saving human lives.

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"I have also developed many innovative and novel disaster modeling and forecasting tools which has been used by various parties for future predictions of natural disasters.

"The research work at UPM has contributed immensely on geospatial modelling tools which have been disseminated to government and disaster teams to be adopted with an aim to facilitate their rescue, evacuation, relief activities and mitigation measures."

Pradhan said his research achievements in the field have made him known throughout the world. He has been named one of the world's most highly cited researchers in the latest Highly Cited Researchers 2016 Report published by Clarivate Analytics, formerly the Intellectual Property & Science business of Thomson Reuters.

He is the first researcher from UPM to rank among the world's most highly-cited researchers, and among six researchers from Malaysia named in the 2016 report as the world's leading and most influential scientific minds.

He earned the distinction by publishing a high number of scientific papers that were ranked among the top one per cent most-cited for his subject field and year of publication. His H-index in SCOPUS was 46.

SCOPUS, the largest abstract and citation database of peer-reviewed literature, ranks him first in the field of GIS and landslides.

With more than 16 years of teaching, research and industrial experiences, Pradhan has written 370 articles, of which 270 were published in science citation index (SCI/SCIE) international journals.

He credited UPM vice-chancellor Professor Datin Paduka Dr Aini Ideris, officials and staff for their support that enabled him to achieve the distinction.

"With UPM's support, I have managed to establish a world-class natural hazard modelling research team in the country," he said.

"I have also managed to secure remote sensing based research grants sponsored by various agencies that include industries (PLUS Bhd) and the government (Ministry of Science, Technology and Innovation Malaysia or MOSTI and Ministry of Higher Education)."