applied sciences

MDPI

*Editorial*

# Editorial for Special Issue: "Application of Artificial Neural Networks in Geoinformatics"

**Saro Lee** [1,2]

[1] Geological Research Division, Korea Institute of Geoscience and Mineral Resources (KIGAM), 124, Gwahak-ro Yuseong-gu, Daejeon 34132, Korea; leesaro@kigam.re.kr

[2] Department of Geophysical Exploration, Korea University of Science and Technology, 217 Gajeong-ro Yuseong-gu, Daejeon 34113, Korea

Received: 27 December 2017; Accepted: 28 December 2017; Published: 2 January 2018

## 1. Introduction

Recently, a need has arisen for prediction techniques that can address a variety of problems by combining methods from the rapidly developing field of machine learning with geoinformation technologies such as GIS, remote sensing, and GPS. As a result, over the last few decades, one particular machine learning technology known as artificial neural networks has been successfully applied to a wide range of fields in science and engineering. In addition, the development of computational and spatial technologies has led to the rapid growth of geoinformatics, which specializes in the analysis of spatial information. Thus, recently, artificial neural networks have been applied to geoinformatics and have produced valuable results in the fields of geoscience, environment, natural hazards, natural resources, and engineering. Hence, this special issue of the journal *Applied Sciences*, "Application of Artificial Neural Networks in Geoinformatics," was successfully planned, and we here publish many papers detailing novel contributions that are of relevance to these topics.

## 2. Applications of Artificial Neural Networks in Geoinformatics

In total, 23 papers were submitted to this special issue, 14 of which were accepted and published, constituting a 61% acceptance rate. The papers in this special issue cover various areas related to the application of artificial neural networks to GIS, remote sensing, and GPS, which are typical tools used by geoinformation researchers. These papers addressed problems such as the detection, assessment, and prediction of landslides, volcanos, forest, ozone, oil spills, buildings, ships, habitat, and traffic.

Four papers used GIS tools with artificial neural networks. The first and second papers, authored by Lee, S., Lee, M., Jung, H. [1] and Oh, H., Lee, S. [2], applied GIS and various machine learning algorithms such as artificial neural networks, support vector machines, and boosted tress to map landslide susceptibility. The third paper, authored by Lee, S., Lee, S., Song, W., Lee, M. [3], applied GIS with artificial neural networks to map potential marten and leopard habitats. The fourth paper, authored by Shah, S., Brijs, T., Ahmad, N., Pirdavani, A., Shen, Y., Basheer, M. [4], used data envelopment analysis in GIS with artificial neural networks to evaluate risks related to road safety.

Seven papers studied the applications of artificial neural networks to remote sensing. Among these, three papers used various image technologies and artificial neural networks for the detection of landslides, oil spills, and ships. Mezaal, M., Pradhan, B., Sameen, M., Mohd, S. H., Yusoff, Z. [5] used airborne laser scanning images to detect landslides. Chen, G., Li, Y., Sun, G., Zhang, Y. [6] used polarimetric synthetic aperture radar images to detect oil spills. Hwang, J., Chae, S., Kim, D., Jung, H. [7] used X-band Kompsat-5 images to detect ships. Additionally, Piscini, A., Romaniello, V., Bignami, C., Stramondo, S. [8] proposed a damage assessment method based on SAR and Sentinel-2 images, and Kadavi, P., Lee, W., Lee, C. [9] analyzed pyroclastic flow deposits using Landsat images. Kwon, S., Jung, H., Baek, W., Kim, D. [10] classified the vertical structures of forests using aerial

orthophoto and Lidar images. Finally, Foody, G. [11] analyzed the impact of sample design on data validation using remote sensing data classified by feedforward neural networks, and then used a validation dataset to test the classification accuracy.

As the another geoinformation tool, GPS was used for real-time transportation mode identification with artificial neural networks by Byon, Y., Ha, J., Cho, C., Kim, T., Yeun, C. [12]. The paper authored by Sameen, M., Pradhan, B. [13] applied artificial neural networks to predict traffic accident recurrence, and Afonso, N., Pires, J. [14] applied artificial neural networks and genetic algorithms to characterize surface ozone behavior.

## 3. Future of Artificial Neural Networks in Geoinformatics

In this special issue, we only included papers on artificial neural networks and geoinformation technology. However, artificial neural networks are just one machine learning technique, albeit one of the most popular. Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. Machine learning explores the study and construction of algorithms that can learn from data and make data-driven predictions or decisions by building a model from sample inputs. There are numerous machine learning techniques, such as decision trees, support vector machines, naive Bayes classifier, clustering, inductive logic programming, and genetic algorithms. These machine learning techniques can be combined with geoinformation technologies, and further studies are required in this area.

As we enter the age of the fourth industrial revolution, artificial intelligence technologies have come to play a very important role in society. Machine learning technologies such as artificial neural networks are expected to play a key role in the fourth industrial revolution, especially in combination with geoinformation technology. However, these technologies do not come out of nowhere; they are developed by scientists. Therefore, many scientists will have to expand on the research presented in this special issue.

**Acknowledgments:** I would like to thank the authors of the papers submitted for this special issue, whether or not they were selected for publication. Also, I thank the reviewers, who are all experts on the theme, and the editorial team of *Applied Sciences*. This special issue was conducted by the Basic Research Project of the Korea Institute of Geoscience and Mineral Resources (KIGAM) funded by the Ministry of Science, ICT. This research (NRF-2016K1A3A1A09915721) was supported by Science and Technology Internationalization Project through National Research Foundation of Korea (NRF) grant funded by the Ministry of Science and ICT.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Lee, S.; Lee, M.; Jung, H. Data Mining Approaches for Landslide Susceptibility Mapping in Umyeonsan, Seoul, South Korea. *Appl. Sci.* **2017**, *7*, 683. [CrossRef]
2. Oh, H.; Lee, S. Shallow Landslide Susceptibility Modeling Using the Data Mining Models Artificial Neural Network and Boosted Tree. *Appl. Sci.* **2017**, *7*, 1000. [CrossRef]
3. Lee, S.; Lee, S.; Song, W.; Lee, M. Habitat Potential Mapping of Marten (*Martes flavigula*) and Leopard Cat (*Prionailurus bengalensis*) in South Korea Using Artificial Neural Network Machine Learning. *Appl. Sci.* **2017**, *7*, 912. [CrossRef]
4. Shah, S.; Brijs, T.; Ahmad, N.; Pirdavani, A.; Shen, Y.; Basheer, M. Road Safety Risk Evaluation Using GIS-Based Data Envelopment Analysis—Artificial Neural Networks Approach. *Appl. Sci.* **2017**, *7*, 886. [CrossRef]
5. Mezaal, M.; Pradhan, B.; Sameen, M.; Mohd Shafri, H.; Yusoff, Z. Optimized Neural Architecture for Automatic Landslide Detection from High-Resolution Airborne Laser Scanning Data. *Appl. Sci.* **2017**, *7*, 730. [CrossRef]
6. Chen, G.; Li, Y.; Sun, G.; Zhang, Y. Application of Deep Networks to Oil Spill Detection Using Polarimetric Synthetic Aperture Radar Images. *Appl. Sci.* **2017**, *7*, 968. [CrossRef]
7. Hwang, J.; Chae, S.; Kim, D.; Jung, H. Application of Artificial Neural Networks to Ship Detection from X-Band Kompsat-5 Imagery. *Appl. Sci.* **2017**, *7*, 961. [CrossRef]

8. Piscini, A.; Romaniello, V.; Bignami, C.; Stramondo, S. A New Damage Assessment Method by Means of Neural Network and Multi-Sensor Satellite Data. *Appl. Sci.* **2017**, *7*, 781. [CrossRef]
9. Kadavi, P.; Lee, W.; Lee, C. Analysis of the Pyroclastic Flow Deposits of Mount Sinabung and Merapi Using Landsat Imagery and the Artificial Neural Networks Approach. *Appl. Sci.* **2017**, *7*, 935. [CrossRef]
10. Kwon, S.; Jung, H.; Baek, W.; Kim, D. Classification of Forest Vertical Structure in South Korea from Aerial Orthophoto and Lidar Data Using an Artificial Neural Network. *Appl. Sci.* **2017**, *7*, 1046. [CrossRef]
11. Foody, G. Impacts of Sample Design for Validation Data on the Accuracy of Feedforward Neural Network Classification. *Appl. Sci.* **2017**, *7*, 888. [CrossRef]
12. Byon, Y.; Ha, J.; Cho, C.; Kim, T.; Yeun, C. Real-Time Transportation Mode Identification Using Artificial Neural Networks Enhanced with Mode Availability Layers: A Case Study in Dubai. *Appl. Sci.* **2017**, *7*, 923. [CrossRef]
13. Sameen, M.; Pradhan, B. Severity Prediction of Traffic Accidents with Recurrent Neural Networks. *Appl. Sci.* **2017**, *7*, 476. [CrossRef]
14. Afonso, N.; Pires, J. Characterization of Surface Ozone Behavior at Different Regimes. *Appl. Sci.* **2017**, *7*, 944. [CrossRef]