A review of Convolutional Neural Networks in Remote Sensing Image

Xinni Liu [1], Fengrong Han [1], Kamarul Hawari Ghazali [1], Izzeldin Ibrahim Mohamed [1], Yue Zhao [2]

[1]Universiti Malaysia Pahang, Pekan, Malaysia
[2]Baoji University of Arts and Sciences, Gaoxin Road #1, Gaoxin District, Baoji 721013, China

ABSTRACT

Effectively analysis of remote-sensing images is very important in many practical applications, such as urban planning, geospatial object detection, military monitoring, vegetation mapping and precision agriculture. Recently, convolutional neural network based deep learning algorithm has achieved a series of breakthrough research results in the fields of objective detection, image semantic segmentation and image classification, etc. Their powerful feature learning capabilities have attracted more attention and have important research value. In this article, firstly we have summarized the basic structure and several classical convolutional neural network architectures. Secondly, the recent research problems on convolutional neural network are discussed. Later, we summarized the latest research results in convolutional neural network based remote sensing fields. Finally, the conclusion has made on the basis of current issue on convolutional neural networks and the future development direction.

KEYWORDS

REFERENCES

[1] NASA: What Is a Satellite? NASA Knows! 2014. (Grades 5–8)

[2] L.P. Zhang, L.F. Zhang, B. Du. 2016. Deep learning for remote sensing data: A technical tutorial on the state of the art. *IEEE Geoscience and Remote Sensing magazine*. 4, 2(June. 2016), 22-40. DOI= http://dx.doi.org/10.1109/MGRS.2016.2540798

[3] L.P. Zhang, G.-S.X., T.F. Wu, L. Lin and X.C. Tai. 2016. Deep Learning for Remote Sensing Image Understanding. *Journal of Sensors*. 2016, 1-2. DOI=http://dx.doi.org/10.1155/2016/7954154

[4] Y. LeCun, B. Boser, J. S. Denker, D. Henderson, R. E. Howard, W. Hubbard and L. D. Jackel. 1989. Backpropagation applied to handwritten zip code recognition. *Neural Computation*. 1, 4(Winter. 1989), 541-551.
DOI=https://doi.org/10.1162/neco.1989.1.4.541

[5] G.E. Hinton, S. Osindero, Y.W. Teh. 2006. A fast learning algorithm for deep belief nets. *Neural Computation*. 18, 7(July. 2006), 1527-1554. DOI=
https://doi.org/10.1162/neco.2006.18.7.1527

[6] …