Residual Shuffling Convolutional Neural Networks for Deep Semantic Image Segmentation Using Multi-Modal Data

Kaiqiang Chen[1,2,*], Michael Weinmann[3], Xin Gao[1], Menglong Yan[1], Stefan Hinz[4], Boris Jutzi[4], Martin Weinmann[4,*]

[1]Key Laboratory of Spatial Information Processing and Application System Technology, Institute of Electronics, Chinese Academy of Sciences, Beijing, P.R. China

[2]University of Chinese Academy of Sciences, Beijing, P.R. China

[3]Institute of Computer Science II, University of Bonn, Bonn, Germany

[4]Institute of Photogrammetry and Remote Sensing, Karlsruhe Institute of Technology, Karlsruhe, Germany

*Corresponding authors:

Kaiqiang Chen: chenkaiqiang14@mails.ucas.ac.cn

Martin Weinmann: martin.weinmann@kit.edu

Brief summary of the applied methodology:

1) Feature extraction:

   - Radiometric features
     (IR, R, G, NDVI, and 4 modified variants of these)

   - Geometric features
     (8 local 3D shape features derived from the 3D structure tensor)

2) Supervised classification:

   - Residual Shuffling Convolutional Neural Network (RSCNN)
     (combines the characteristics of a Residual Network with the advantages of atrous convolution and a shuffling operator)

The corresponding paper has been submitted for publication in the *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences* and is currently under review.