Deep learning applied to multi-temporal geometric surveys in the environmental field

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Deep learning and Photogrammetry

In recent years, the use of remote control vehicles (UAVs) in aerial photogrammetry for the acquisition of high resolution nadiral or oblique images has opened new fields of investigation and expanded the intervention space, thanks to their high versatility and relatively low cost. In particular, the high resolution on the ground, which can be pushed to a sub-centimeter level if required, has proven to be ideal for the processing of new and traditional photogrammetric products like Point Clouds, Digital Terrain Models (DTM) and Orthophotos.

Even if in the last decade the processing techniques of photogrammetric blocks have turned highly automated and optimized, still some specific criticalities remain in multi-temporal surveys:

a) the stability of the reference system, ensured by the survey of control points on the ground, often problematic or dangerous in separate contexts;

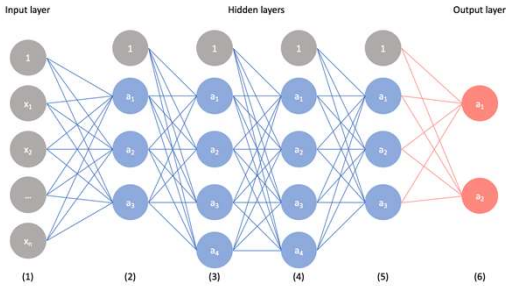
b) b) the search for homologous points in situations where the characteristics of the ground or the lighting conditions are difficult to make their homogeneous identification for the orientation operations of the blocks;

c) c) the processing and comparison / georeferencing of the photogrammetric products referred to above at the different periods.

The tools that could prove useful, albeit to varying degrees, to overcome these criticalities are neural networks.

In recent years, the use of neural networks, or deep learning, has been the focus of several research studies aimed at adapting these media in the field of photogrammetry.

In particular, the attention is focused on Convolutional Neural Networks. These systems are specifically developed to act and learn in ways similar to the animal nervous system, simulating the response to a specific stimulus by a neuron.



Goals of the research

- Implement convolutional neural networks (CNNs) in the matching process of homologous points on the frames for the purpose of photogrammetric block orientation.

- Involve convolutional neural networks in the comparison of multi-temporal surveys for environmental monitoring using advanced feature-based recognition patterns. Automate these processes and reduce associated processing costs.

- Reduce the risk for operators associated with identifying ground control points (GCPs) in situ.