Supporting risk management in the Caribbean by application of Deep Learning for object classification of aerial imagery with MATLAB

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The presented work focuses on disaster risk management of cities which are prone to natural hazards. Based on aerial imagery captured by drones of regions in Caribbean islands, we show how to process and automatically identify roof material of individual structures using a deep learning model. Deep learning refers to a machine learning technique using deep artificial neural networks. Unlike other techniques, deep learning does not necessarily require feature engineering but may process raw data directly. The outcome of this assessment can be used for steering risk mitigations measures, creating risk hazard maps or advising municipal bodies or help organizations on investing their resources in rebuilding reinforcements. Data at hand consists of images in BigTIFF format and GeoJSON files including the building footprint, unique building ID and roof material labels. We demonstrate how to use MATLAB and its toolboxes for processing large image files that do not fit in computer memory. Based on this, we perform the training of a deep learning model to classify roof material present in the images. We achieve this by subjecting a pretrained ResNet-18 neural network to transfer learning. Training is further accelerated by means of GPU computing. The accuracy computed from a validation data set achieved by this baseline model is 74%. Further tuning of hyperparameters is expected to improve accuracy significantly.