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One-to-Many Registration of Landsat Imagery

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Abstract. This paper presents an innovative methodology for the registration of multiple satellite scenes by using a global Least Squares adjustment. The main advantage in relation to traditional approaches concerns the combined use of all the images of the dataset to obtain a more robust and comprehensive registration along with a statistical evaluation of the solution accuracy. This technique avoids standard matching solutions (implemented in several commercial software packages) where pairs of images are independently co-registered on the basis of an "one-to-one" approach, starting from points extracted via independent "image-to-master" matching. Once a set of corresponding multi-image features is extracted from the whole dataset, the implemented algorithm provides a global mapping function for an adjustment process that simultaneously includes all the available data. The multi-image matching process (coined "one-to-many" approach) is performed by exploiting multi-temporal image combinations to obtain features visible in as many scenes as possible. The features are then clustered to generate a regular structure of image coordinates for the following Least Squares adjustment phase. The method is able to manage features visible in as many images as possible and is therefore a powerful alternative for registering satellite data which do not directly share common features with the master. Some examples will be illustrated to report the feasibility of the registration algorithm and to prove its sub-pixel accuracy for the specific case of Landsat images.

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