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Generative Adversarial Networks for automatic detection of mounds in Digital Terrain Models (Mars Arabia Terra)

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Mounds are positive relief features that can be ascribed to a variety of phenomena; they can be related to monogenic edifices due to spring or mud volcanism, rootless cones on top of lava flows, pingos and so on. In the case of sedimentary or spring case of mud extrusion, these mounds can be widespread regionally and/or contained in large complex craters, often in populations of several hundreds or thousands. Previous work on detection of such mounds in the Mars Arabia Terra involved exploiting morphometric parameters and mapping them onto Digital Terrain Models. In this work, we take a step further and develop more general methods to automatically detect them without explicitly defining the topographical features. We achieve this by using a generative framework trained in an adversarial fashion to produce realistic mappings with only a small number of training samples. Further, we introduce a terrain simulator based on this framework that learns the terrain simulation parameters, and allows us to induce domain specific knowledge automatically into the network. Our key results indicate that learning latent representations based on simulations can offer improvements in detection accuracy, while making it more robust to changing terrain scenarios.