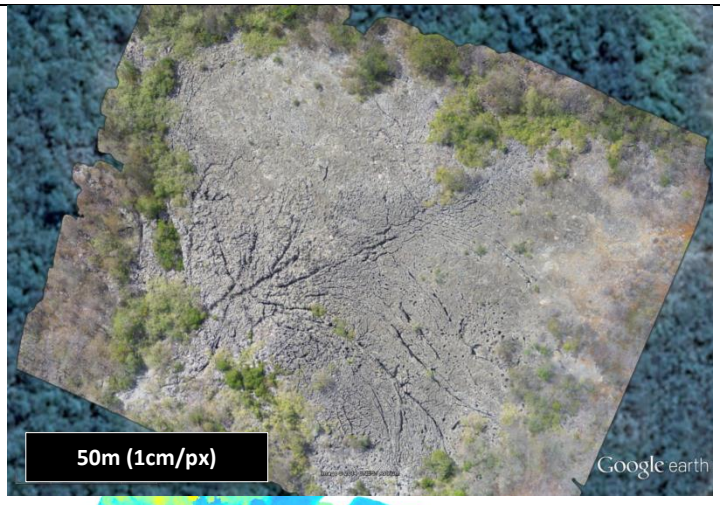
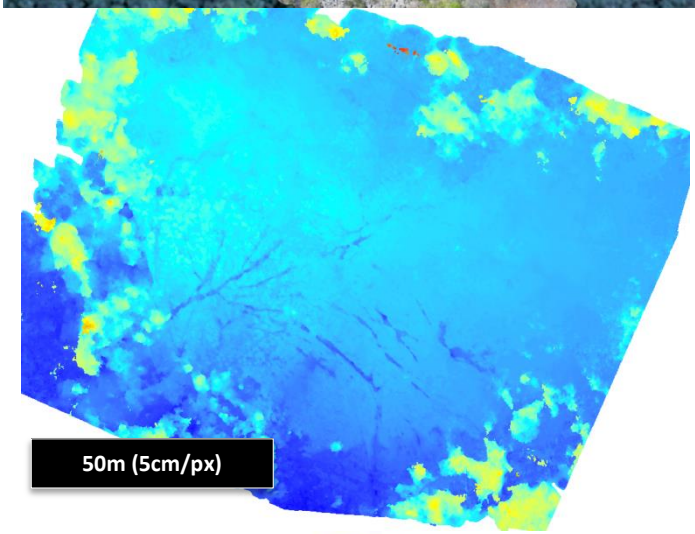
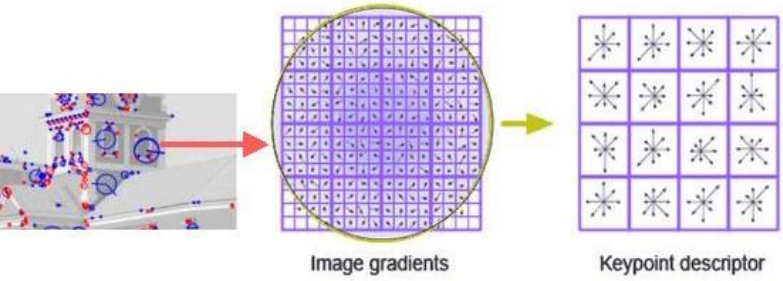
Automated recognition and extraction of geological features from Drone imagery







Top to bottom: high-resolution orthophoto of outcropping fractures in Brazil; DEM of the same outcrop; visual summary of the learning algorithms for auto-extraction of 3D data

Introduction

Carbonate reservoirs worldwide still account for 60% of the conventional oil and gas resources. Natural fractures play an important role in production from these reservoirs, but their impact on fluid flow is still poorly understood.

Outcrop analogue studies of natural fracture patterns help to better understand the behaviour of fracture patterns, as well as the relation between small-scale fractures and seismic-scale deformation. However, to quantitatively characterize natural fracture patterns, we need large and accurate datasets.

Using a small UAV (or drone) we generate high-resolution orthophotos and Digital Elevation Models (DEMs) of fractured outcrops. This process is fast and mostly automatic. However, interpretation of fractures is still done manually using GIS software.

Integrating remote sensing & geoscience

Within the field of Remote Sensing, methods exist for automatic extraction of relevant features, such as fractures. Computer vision, machine learning and pattern recognition provide mathematical methods which can be used to develop algorithms to apply recognition, matching and classification on input images. Furthermore, 3D scenes can be generated, 3D measurements can be done and recognition/classification can be done fully automatically. These methods have been successfully applied on urban scenes, but not yet tested on geological features.

Goal of MSc thesis

In this study, we would like to benefit from 3D scene generation, local characteristic feature and robust descriptor extraction, recognition and classification of natural fracture patterns. Algorithms are ready to implement and test, yet basic programming knowledge of e.g. Matlab or C++ is required.

Supervision

This is a joint project between the sections of Applied Geology and Optical and Laser Remote Sensing. This topic is suitable for, but not limited to MSc students in Petroleum Engineering/Reservoir Geology and Remote Sensing. The final project can be partly tuned to fit the background of the interested student.

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