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Multi-class support vector machines for paint condition assessment on the Sydney Harbour Bridge using hyperspectral imaging

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Abstract. Assessing the condition of paint on civil structures is an important but challenging and costly task, in particular when it comes to large and complex structures. Current practices of visual inspection are labour-intensive and time-consuming to perform. In addition, this task usually relies on the experience and subjective judgment of individual inspectors. In this study, hyperspectral imaging and classification techniques are proposed as a method to objectively assess the state of the paint on a civil or other structure. The ultimate objective of the work is to develop a technology that can provide precise and automatic grading of paint condition and assessment of degradation due to age or environmental factors. Towards this goal, we acquired hyperspectral images of steel surfaces located at long (mid-range) and short distances on the Sydney Harbour Bridge with an Acousto-Optics Tunable filter (AOTF) hyperspectral camera (consisting of 21 bands in the visible spectrum). We trained a multi-class Support Vector Machines (SVM) classifier to automatically assess the grading of the paint from hyperspectral signatures.
Our results demonstrate that the classifier generates highly accurate assessment of the paint condition in comparison to the judgement of human experts.

Keywords: paint assessment; civil structures; corrosion; multi-class SVM; hyperspectral imaging

1. Introduction

1.1 Paint condition monitoring

Protective coatings are applied to the vast majority, if not all, steel structures located in outside environments. Coatings shield the structure from damaging aspects of the environment including sunlight, humidity, corrosive agents such as salts and windborne abrasives.

Without protective coatings the life of steel structures would be severely shortened. It is crucial

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