

**Abstract:**

One of the main assumptions in outdoor computer vision is that the weather is clear. This is quite practical as it allows us to, for example, model the sun as a directional light source, or assume that light travels unaltered from the scene to the camera. In clear weather, these assumptions are reasonable: the sun rays are indeed parallel at the scene, and the atmosphere behaves like a transparent medium and transmits light with very little attenuation or scattering. However, varying weather conditions such as clouds or rain break these hypotheses, thus creating additional challenges to computer vision algorithms which must be robust to these effects.

In this talk, we will discuss three scenarios where an explicit reasoning about the weather conditions of an outdoor image helps in gaining a better understanding of the problem at hand. First, a novel approach for outdoor lighting estimation from a single image will be presented. The approach relies on a non-parametric sky model that is learned from a large dataset of HDR sky captures. Second, we will analyze the applicability of photometric stereo (PS) under natural, outdoor illumination. Again, a large dataset of HDR skies will help us understand the conditions under which outdoor PS can (or cannot) work. Third, we will see how a novel physics-based rain rendering pipeline can be leveraged to characterize the behavior of common computer vision algorithms in the presence of rain, and how their performance can subsequently be improved.