

MIXED BETA REGRESSION WITH PENALIZED SPLINES FOR SEVERITY IN PLANT DISEASES

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Severity in plant diseases is quantified as the amount of plant material affected by the disease, and is usually expressed as a continuous variable in a 0-1 scale. Since plant diseases are monitored along the crop's lifecycle, the modelling of severity progress curves needs to incorporate the longitudinal structure of the data. Mixed beta regression has emerged as an appealing alternative to model this. However, when the average and the subject-specific curves do not follow a parametric form, semi-parametric methods are required. We propose a mixed beta regression with smooth average curves and subject-specific curves to model severity progress curves. Parameters in the proposed model are estimated via maximum likelihood. The roughness parameters in the penalized splines are chosen using traditional model selection criteria (e.g., BIC or AIC). The proposed semi-parametric method allows to model flexible shapes for disease progress curves, and can be used to compare treatments or conditions while taking into account the longitudinal and design structures of the data. We apply the proposed method to model the severity of Black Sigatoka in an experimental banana plantation in Isabel, Puerto Rico, designed to compare different control practices. The use of the proposed method yields very useful results that allow plant pathologists and crop managers to understand, monitor and control diseases.