BAYESIAN MIXTURE MODELS FOR ANALYSIS OF TIME SERIES OF SATELLITE IMAGERY: MONITORING WATER QUALITY MEASURES

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We extend Bayesian mixture models to incorporate spatial information provided in a time series of satellite images. Inference on mixture parameters, with pixel allocation modelled using a Markov Random field, uses a two stage Gibbs sampler. The number of components is estimated using the Reversible Jump algorithm. We extend the model to incorporate the longitudinal aspect of the data using perturbations on the already computed component parameters. The mixture model estimates can be monitored using control charting techniques, in particular the Individuals chart and a CUSUM, which is monitored in conjunction with a change point regression model. This work is applied to satellite images of various water quality measures for the Great Barrier Reef, off the coast of Queensland, Australia. Cost-effective methods of broad-scale monitoring of trends are of interest due to the areas environmental and economic importance. Algorithms based on measures of reflectance are used to estimate the level of chlorophyll for pixels within a body of water. Areas of environmental concern have high levels of chlorophyll, with estimated component means greater than the acceptable limit for inshore and offshore sites. For components of interest, the estimated parameters from the mixture can be monitored with control charts. This provides managers with a statistical technique for monitoring special events and long term trends which warrant investigation and possibly intervention.