Correlated component analysis as proposed by Dmochowski, Sajda, Dias, and Parra (2012) is a tool for investigating brain process similarity in the responses to multiple views of a given stimulus. Correlated components are identified under the assumption that the involved spatial networks are identical. Here we propose a hierarchical probabilistic model that can infer the level of universality in such multiview data, from completely unrelated representations, corresponding to canonical correlation analysis, to identical representations as in correlated component analysis. This new model, which we denote Bayesian correlated component analysis, evaluates favorably against three relevant algorithms in simulated data. A well-established benchmark EEG data set is used to further validate the new model and infer the variability of spatial representations across multiple subjects.