Model-based Image Registration

Abstract

Statistical models of appearance possess the ability to faithfully describe shape variation, as well as the variation in pixel intensities. Nonetheless, in order for such models to synthesise valid full appearances, it is essential that landmarks can be consistently identified in the training sets defining these models. One way of automatically achieving data landmarking is to establish an overlap across the training set, much as is already done in image registration.

We contend that the task of registration must seek a globally correct answer, rather than applying transformations that are reliant on the choice of a single reference image. The intrinsic power of appearance models, as well as Minimum Description Length considerations, allow us to define a fully automatic group-wise non-rigid registration scheme.

Various observations motivated us to investigate the innate bonds between non-rigid image registration and appearance models. Unification of the two will be mutually beneficiary and can entail a novel image analysis and alignment framework.

A complex and highly flexible application we constructed and called AART (Autonomous Appearance-based Registration Test-bed) provides proof of the premise above. It benchmarks genuine registration algorithms against other well-performing pair-wise algorithms and newly-conceived methods to illustrate the advantages gained by unifying registration and statistical modeling.