

Title: Image registration by means radial basis functions

Author: Pavel Vácha

Department: Institute of Information Theory and Automation, AS CR

Supervisor: Doc. Ing. Jan Flusser, DrSc. ÚTIA AV ČR

Supervisor's e-mail address: flusser@utia.cas.cz

Abstract: This work studies image registration, in particular the construction of the mapping. For this purpose, we will use a Gaussian function, which has intrinsic localized behavior, in contrary to the commonly used Thin Plate Spline basis. We will focus on automatic smoothing parameter selection and introduce a new method in which we determine the best values for all free parameters according to the chosen criterion. We consider the following criteria: Generalized Cross Validation (GCV), Cross Validation (CV), Robustified Cross Validation (RCV), Akaike Information Criterion (AIC), and Corrected Akaike Information Criterion (cAIC). Finally, we choose GCV criterion since it yields the best results even for small datasets. It turns out that mapping based on Gaussian functions with proposed method outperforms the TPS in the registration of locally deformed images. The proposed method is suitable for image registration with local deformation, e.g. in medical applications. It could be also used for warping and approximation of two-dimensional functions.

Keywords: image registration, Gaussian radial basis function, smoothing parameter selection, Generalized Cross Validation