Motivation
Virtual Physiological Human is a project that aims for creation of computer model of human body and processes inside. If successful, it should have variety of usage starting with increasing efficiency of a patient treatment and ending with support of medical students and practitioners.

Data
Lots of data are required in order to build a complete model of a single person. These data are supposed to originate from standard medical examinations during patient's life. Such scans however have various formats, dimensions and types as they come from various scanners, e.g. MRI or EKG. Therefore processing using transformations is required.

Transformation

Registration
Find a transformation of the data set A that aligns it with the data set B. Example: To which voxel of the MRI scan B does a particular voxel of the scan A match?

Multi-morphing
Combine n datasets into a single new dataset that mix their features. Example: Combine data from general library to get missing data for a specific patient.

Goal
To derive a fully automatic method for multi-morphing of surface muscle meshes that can handle non-manifold models of the same object and create an average model with better mesh quality to improve stability of numerical mesh deformation filter.

Solution
A fully automatic method for multi-morphing of surface meshes

- Remove non-manifolds and holes
  - Input: app. aligned meshes
  - Output: manifold meshes + reliability weights

- Align meshes using PCA
  - Input: meshes
  - Output: approximately aligned meshes

- Non-rigid alignment using modified ICP
  - Input: manifold-meshes
  - Output: aligned meshes

- Multi-morph meshes
  - Input: manifold meshes + reliability weights + aligned meshes
  - Output: morphed mesh

Implementation
C++ VTK filter with GUI based on Qt. Experiments done with individual method steps and real data usage.