

## AUTOMATIC PRE-ALIGNMENT OF MULTIMODALITY RAT BRAIN IMAGES USING PRINCIPAL AXES TRANSFORMATION

J. Pascau<sup>1</sup>, J. Vaquero<sup>1</sup>, M. Soto<sup>1</sup>, R. Cacho<sup>1</sup>, J. Sánchez<sup>1</sup>, A. Santos<sup>2</sup>, M. Desco<sup>1</sup>;

<sup>1</sup>Hospital General Universitario Gregorio Marañón, Madrid, SPAIN, <sup>2</sup>ETSI

Telecomunicación. Universidad Politécnica de Madrid., Madrid, SPAIN.

**Introduction:** The use of small animal studies of different modalities is nowadays widespread, since functional studies like positron emission tomography (PET) or single photon emission computed tomography (SPECT) are better analyzed when mapped to the underlying anatomical structure coming from magnetic resonance imaging (MRI) or computed tomography (CT). The different positioning of the animals in the scanners results in the need for automated image registration methods. One important drawback of the existing algorithms is their limited capture range: in case of large initial misregistration (large translations and rotations) the optimization may not converge to the right solution, and the images do not become correctly coregistered. To avoid this problem we propose the use of a pre-alignment step based on the principal axes transformation.

**Materials and Methods:** To test this approach we acquired three rat brain image pairs from different modalities: CT with 2-deoxy-2-[F-18]fluoro-D-glucose (FDG)-PET, MR with FDG-PET and MRI with alpha-methyltyrosine PET. These studies were co-registered using external markers, being the resulting transformation our gold standard. 100 random transformations were applied to every co-registered pair to provide different values of known initial misregistration. The images were realigned by Normalized Mutual Information with Powell optimization using or not the pre-alignment step.

**Results:** Automatic registration method alone provided good results (>85% success) when initial misalignment did not exceed 10 mm in translation and 15° in rotation, but not more than 30% of success was achieved for larger initial misalignments (up to 20 mm and up to 45°). On the contrary, when using the pre-alignment step the proportion of successful registrations increased noticeably (> 70%).