1. FINAL PUBLISHABLE SUMMARY REPORT

The *CARToon* project developed a new algorithm called *LazyBrush* allowing interactive labelling of hand-drawn cartoon animations. In contrast to previously published approaches it does not rely on style-specific features and is easily applicable to a broad class of different drawing styles requiring comparable or even less manual effort. In addition to this it is also not sensitive to imprecise placement of brush strokes which makes labelling of thin structures less tedious and brings significant time savings (see Figure 1).

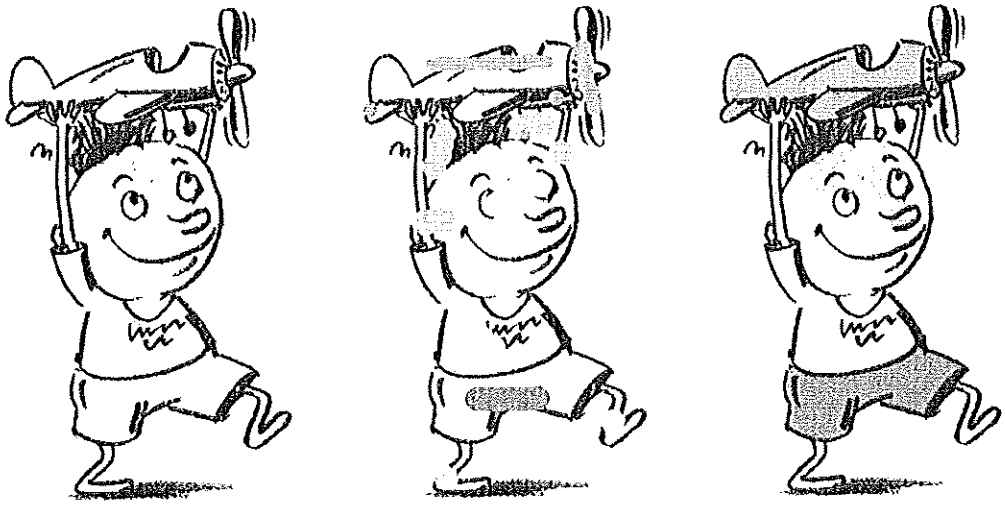

Figure 1: Painting with LazyBrush algorithm – scanned hand-drawn image (left), user-provided color strokes (middle), resulting painted image (right).

The algorithm is described in the paper **LazyBrush: Flexible Painting Tool for Hand-drawn Cartoons** that has been accepted as a full paper for a European premier event in computer graphics: Eurographics 2009 (Munich, Germany, 30th March – 3rd April 2009) and published as a journal paper in *Computer Graphics Forum* (Volume 28, Issue 2, pages 599–608). In addition to that couple of speed-up techniques have been developed to allow processing of high-resolution footage used in movie industry. These were presented in a poster titled **LazyBrush HD** that won the ***Best Poster Award*** at SBIM–NPAR 2010 (Annecy, France, 7th – 10th June 2010).

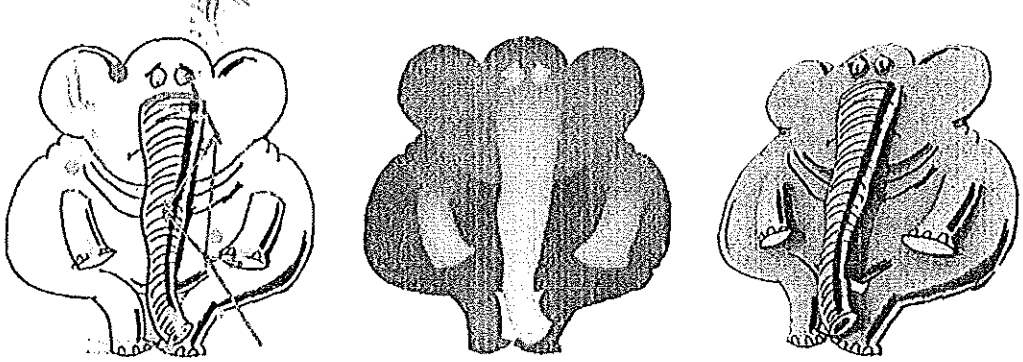

Figure 2: Adding depth to cartoons using sparse depth (in)equalites – scanned hand-drawn image with user-specified constraints (left), resulting depth map (middle), textured 3D model (right).

Although the *LazyBrush* algorithm was originally motivated by the needs of ink-and-paint pipeline it is applicable in more general contexts such as enhancement of the existing footage, namely the estimation of depth and normal maps necessary for stereoscopic display, 3D-like shading and partial 3D reconstruction (see Figure 2). This was demonstrated in the paper **Adding Depth to Cartoons Using Sparse Depth (In)equalities** that won prestigious ***Günter Enderle Best Paper Award*** at Eurographics 2010 (Norrköping, Sweden, 3rd – 7th May 2010) and was published as a journal paper in *Computer Graphics Forum* (Volume 29, Issue 2, pages 615–623).

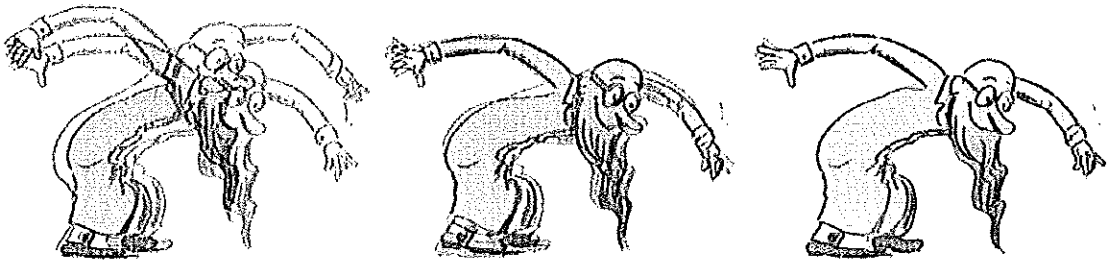

***Figure 3**: Estimating dense correspondences between hand-drawn images – two animation phases superimposed (left), output of proposed as-rigid-as-possible image registration algorithm (middle), final refinement based on free-form image registration (right).*

CARToon project also developed a new algorithm able to automatically establish dense correspondences between two cartoon drawings (see Figure 3). Similarly to *LazyBrush* algorithm this new techniques opens potential for implementing various new applications including originally proposed skeleton transfer, unsupervised inbetweening, example-based shape deformation, auto-painting, editing, and motion retargeting. The algorithm is described in the paper **As-Rigid-As-Possible Image Registration for Hand-drawn Cartoon Animations** and was accepted as a full paper for NPAR 2009 (New Orleans, USA, 1st – 7th August 2009) a premier event in the field of non-photorealistic animation and rendering co-located with SIGGRAPH 2009. It has been published by ACM in *Proceedings of the 7th International Symposium on Non-Photorealistic Animation and Rendering* (pages 25–33).