

## Tutorial IEEE Visualization 2007

### Advanced Visual Medicine: Techniques, Applications and Software

Diffusion Tensor Imaging Visualization Techniques and Applications - *Anna Vilanova*

### References

- [1] A method for clustering white matter fiber tracts. *American Journal of Neuroradiology (AJNR)*, 27(5):1032–1036, 2006.
- [2] A. Bartesaghi and M. Nadar. Segmentation of anatomical structure from dti-mri. *Biomedical Imaging: Nano to Macro, IEEE International Symposium on*, pages 61–64, 2006.
- [3] P.J. Basser, J. Mattiello, and D. LeBihan. Estimation of the effective self-diffusion tensor from the NMR spin echo. *MR Journal*, 103(3):247–54, 1994.
- [4] P.J. Basser, S. Pajevic, C. Pierpaoli, J. Duda, and A. Aldroubi. In vivo fiber tractography using DT-MRI data. *MR in Medicine*, 44:625–632, 2000.
- [5] P.J. Basser and C. Pierpaoli. Microstructural features measured using diffusion tensor imaging. *MR Journal*, pages 209–219, 1996.
- [6] P.G. Batchelor, D.L.G. Hill, F. Calamante, and D. Atkinson. Study of connectivity in the brain using the full diffusion tensor from MRI. In *IPMI, Conf. Proc.*, pages 121–133, 2001.
- [7] A. Brun, H. Knutsson, H. J. Park, M. E. Shenton, and C.-F. Westin. Clustering fiber tracts using normalized cuts. In *MICCAI'04, Conf. Proc.*, Lecture Notes in Computer Science, pages 368–375, 2004.
- [8] Anders Brun, Hae-Jeong Park, Hans Knutsson, and Carl-Fredrik Westin. Coloring of DT-MRI fiber traces using laplacian eigenmaps. In *EUROCAST'03, Conf. Proc., Lecture Notes in Computer Science 2809*, pages 564–572. Springer Verlag, February 24–28 2003.

- [9] M. Catani, R. J. Howard, S. Pajevic, and D. K. Jones. Virtual in vivo interactive dissection of white matter fasciculi in the human brain. *NeuroImage*, 17:77–94, 2002.
- [10] I. Corouge, G. Gerig, and S. Gouttard. Towards a shape model of white matter fiber bundles using diffusion tensor MRI. In *IEEE International Symposium on Biomedical Imaging, Conf. Proc.*, pages 344–347, 2004.
- [11] Z. Ding, J.C. Gore, and A.A. Anderson. Case study: reconstruction, visualization and quantification of neural fiber pathways. In *IEEE Visualization, Conf. Proc.*, pages 453–456, 2001.
- [12] Z. Ding, J.C. Gore, and A.A. Anderson. Classification and quantification of neuronal fiber pathways using diffusion tensor MRI. *MR in Medicine*, 49(4):716–721, 2003.
- [13] P. Douek, R. Turner, J. Pekar, N. Patronas, and D. LeBihan. MR color mapping of myelin fiber orientation. *J. Comput. Assist. Tomogr*, 15:923–929, 1991.
- [14] B.J. Jellison et al. Diffusion tensor imaging of cerebral white matter: a pictorial review of physics, fiber tract anatomy, and tumor imaging patterns. *AJNR Am J Neuroradiology*, 25(3):356–369, 2004.
- [15] A.K. Jain and R.C. Dubes. *Algorithms for Clustering Data*. Prentice Hall, 1988.
- [16] A.K. Jain, M.N. Murty, and P.J. Flynn. Data clustering: a review. *ACM Computing Surveys*, 31(3):264–323, 1999.
- [17] G. Kindlmann. Superquadric tensor glyphs. In *Proceedings IEEE TVCG/EG Symposium on Visualization 2004*, pages 147–154, May 2004.
- [18] G. Kindlmann, D. Weinstein, and D.A. Hart. Strategies for direct volume rendering of diffusion tensor fields. *IEEE Trans. on Visualization and Computer Graphics*, 6(2):124–138, 2000.
- [19] D. LeBihan. Molecular diffusion nuclear magnetic resonance imaging. *Magn. Reson. Quant.*, 17:1–30, 1991.
- [20] C. Lenglet, M. Rousson, and R. Deriche. Dt segmentation by statistical surface evolution. *IEEE Transactions on Medical Imaging*, 25(06):685–700, jun 2006.

- [21] B. Moberts, A. Vilanova, and J.J. van Wijk. Evaluation of fiber clustering methods for diffusion tensor imaging. In *IEEE Visualization Conference Proceedings*, pages 65–72, Oct 2005.
- [22] L. O’Donnell, S. Haker, and C.F. Westing. New approaches to estimation of white matter connectivity in diffusion tensor MRI: Elliptic PDE’s and geodesics in tensor-warped space. In *MICCAI, Conf. Proc.*, pages 459–466, 2002.
- [23] L. O’Donnell and C-F. Westin. White matter tract clustering and correspondence in populations. In *MICCAI, Conf. Proc.*, pages 140–147, 2005.
- [24] T. Peeters, A. Vilanova, G.J. Strijkers, and B.M. ter Haar Romeny. Visualization of the fibrous structure of the heart. In *Vision Modeling and Visualization- VMV 2006*, pages 309–317, Nov 2006.
- [25] C. Pierpaoli, A.S. Barnett, S. Pajevic, A. Virta, and P.J. Basser. Validation of DT-MRI tractography in the descending motor pathways of human subjects. In *ISMRM, Conf. Proc.*, page 501, 2001.
- [26] C. Pul, J. Buijs, A. Vilanova, F.G. Roos, and P.F.F. Wijn. Fiber tracking in newborns with perinatal hypoxic-ischemia at birth and at 3 months. *Radiology*, 240(1):203–214, 2006.
- [27] F.B. Sachse. *Computational Cardiology: Modeling of Anatomy, Electrophysiology, and Mechanics*. LNCS Vol. 2966. Springer Verlag, 2004.
- [28] Thomas Schultz, Bernhard Burgeth, and Joachim Weickert. Flexible segmentation and smoothing of DT-MRI fields through a customizable structure tensor. In *Advances in Visual Computing*, volume 4291 of *Lecture Notes in Computer Science*, pages 455–464. Springer, 2006.
- [29] J.S. Shimony, A.Z. Snyder, N. Lori, , and T.E. Conturo. Automated fuzzy clustering of neuronal pathways in diffusion tensor tracking. In *Soc. Mag. Reson. Med. 10, Conf. Proc.*, May 2002.
- [30] A. Sigfridsson, T. Ebbers, E. Heiberg, and L. Wigström. Tensor field visualisation using adaptive filtering of noise fields combined with glyph rendering. In *IEEE Visualization, Conf. Proc.*, pages 371–378, 2002.
- [31] A. Szafer, J. Zhong, and J.C. Gore. Theoretical model for water diffusion in tissues. *MR in Medicine*, 33:697–712, 1995.

- [32] A. Vilanova, G. Berenschot, and C. van Pul. DTI visualization with streamsurfaces and evenly-spaced volume seeding. In *VisSym '04 Joint EG – IEEE TCVG Symposium on Visualization, Conf. Proc.*, pages 173–182, 2004.
- [33] A. Vilanova, S. Zhang, G. Kindlmann, and D. Laidlaw. *Visualization and Image Processing of Tensor Fields*, chapter An Introduction to Visualization of Diffusion Tensor Imaging and its Applications, pages 121–153. Springer Verlag series Mathematics and Visualization, 2006.
- [34] J.J. Volpe. *Neurology of the Newborn*. W.B. Saunders Company, 1995.
- [35] S. Wakana, H. Jiang, L.M. Nagae-Poetscher, P.C.M. van Zijl, and S. Mori. Fiber tract based atlas of human white matter anatomy. *Radiology*, 230:77–87, 2004.
- [36] Z. Wang and B.C. Vemuri. Dt segmentation using an information theoretic tensor dissimilarity measure. *Medical Imaging, IEEE Transactions on*, 24(10):1267– 1277, 2005.
- [37] D. Weinstein, G. Kindlmann, and E.C. Lundberg. Tensorlines: advection-diffusion based propagation through diffusion tensor fields. In *IEEE Visualization, Conf. Proc.*, pages 249–253, 1999.
- [38] A. Wenger, D. Keefe, S. Zhang, and D.H. Laidlaw. Interactive volume rendering of thin thread structures within multivalued scientific datasets. *IEEE Trans. on Visualization and Computer Graphics*, 2004. In press.
- [39] C.F. Westin, S. Peled, H. Gubjartsson, R. Kikinis, and F.A. Jolesz. Geometrical diffusion measures for MRI from tensor basis analysis. In *ISMRM, Conf. Proc.*, page 1742, April 1997.
- [40] S. Zhang, C. Demiralp, and D.H. Laidlaw. Visualizing diffusion tensor MR images using streamtubes and streamsurfaces. *IEEE Trans. on Visualization and Computer Graphics*, 9(4):454–462, 2003.
- [41] S. Zhang and D. H. Laidlaw. Hierarchical clustering of streamtubes. Technical Report CS-02-18, Brown University Computer Science Department, August 2002.
- [42] S. Zhang and D.H. Laidlaw. Hierarchical clustering of streamtubes. Technical Report CS-02-18, Brown University Computer Science Dep., August 2002.

- [43] L. Zhukov and A.H. Barr. Oriented tensor reconstruction: tracing neural pathways from diffusion tensor MRI. In *IEEE Visualization, Conf. Proc.*, pages 387–394, 2002.
- [44] L. Zhukov, K. Museth, D. Breen, R. Whitaker, and A. Barr. Level set modeling and segmentation of dt-mri brain data. *J. Electronic Imaging*, 12(1):125–133, 2003.
- [45] U Ziyan, D. Tuch, and C-F Westin. Segmentation of thalamic nuclei from DTI using spectral clustering. In *MICCAI, Conf. Proc.*, Lecture Notes in Computer Science 4191, pages 807–814, October 2006.