

打造卓越执行力团队  
共创合作与互赢平台

中国科学院自动化研究所智能医学研究中心

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## 智能医学研究中心2010年度报告

Intelligent Medical Research Center  
Annual Report 2010





田捷

中国科学院自动化研究所  
智能医学研究中心主任

## 中心年度工作总结

中国科学院自动化研究所智能医学研究中心成立于1996年,是一个团结进取、奋发向上的年轻集体。在田捷研究员的带领下,经过十多年的发展,在结构成像、功能成像、分子影像相关基础理论研究、关键技术研发、成果推广应用等方面取得显著科研成果。

在项目申请方面,中心在国家重大项目申请方面取得突出进展:成功实现国家重大基础研究973项目“多模态分子影像关键科学问题研究”的滚动;国家自然科学基金科学仪器基础研究专项的获批成功实现我所自1998年以来在该类项目上零的突破;另外,还获得国家自然科学基金面上项目资助3项、国家自然科学基金专项资助1项、海外及港澳学者合作研究基金1项、北京市自然科学基金重点项目1项,2010年实到科研经费总计657万元。

在科研及获奖方面,围绕各项科研项目开展的研究工作进展顺利,2010年共发表SCI检索的国际期刊文章47篇、国际会议文章17篇,新授权发明专利7项、新申请发明专利3项(其中国际PCT专利2项),分子影像研究成果作为第一完成单位获国家技术发明二等奖;田捷获中国科学院院地合作先进个人二等奖、中国科协颁发的“全国优秀科技工作者”等荣誉称号。

在队伍建设与人才培养方面,2010年毕业博士、硕士6名,新招收博士、硕士10名。课题组在院“外国专家特聘研究员计划”以及“外籍青年科学家计划”的资助下,积极引进Prof.Akay、Dr.Ripoll外籍专家教授2名。

本着“打造卓越执行力团队 共创合作与互赢平台”的团队建设理念,我们希望逐步完善各项管理制度,在今后几年逐步实现“提升国际影响 形成产业应用”的阶段发展目标,最终将中心建设成为国际具有学术影响力的研究型团队。



2010年中心全体人员合影

## 获奖情况

1. “小动物多模态光学分子影像成像方法与系统”获国家技术发明二等奖  
第一完成人:田捷,证书号:2010-F-220-2-02-R01
2. 田捷研究员当选“全国优秀科技工作者”
3. 田捷研究员获中国科学院院地合作奖,先进个人二等奖(科技类)

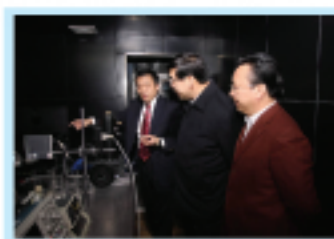


## 在研科研项目

1. 分子影像关键科学技术问题的研究,国家重点基础研究973计划,2006-2010,644.21万(3000万)
2. 针刺中枢神经动态特性研究,院知识创新工程重要方向项目,2009-2011,360万(500万)
3. 基于分子影像的低成本淋巴瘤疾病早期快速检测设备,院知识创新重要方向项目,2009-2012,100万
4. 儿童和成年人面孔和汉字加工的神经机制,国自然重大国际合作项目,2010-2012,60万(100万)
5. 基于生物特征的网络安全防护模型,国家高技术研究发展863计划,2008-2010,43.5万(100万)
6. 基于加密生物特征模板的身份认证技术研究,北京自然科学基金重点项目,2009-2011,43万(50万)
7. 计算机辅助肝脏手术前风险定量分析预测及术后功能评估系统,院知识创新重要方向项目,2009-2010,30万(50万)
8. 活体指纹检测算法的研究,国家自然科学基金面上项目,2009-2011,36万
9. 脑纤维微结构连接度算法研究,国家自然科学基金面上项目,2010-2012,35万
10. 基于功能磁共振成像的针刺效应网络研究,国家自然科学基金面上项目,2009-2011,34万
11. 大规模指纹数据库资源的建设和管理,中国科学院“十一五”科学数据库项目,2009-2010,22万
12. 面向医学科研管理信息化中关键技术研究,国家自然科学基金专项基金项目,2010,10万
13. 基于贝叶斯框架的自发荧光断层成像重建方法研究,北京市教委科技重点项目,2009-2011,11万

## 2011年新立项项目

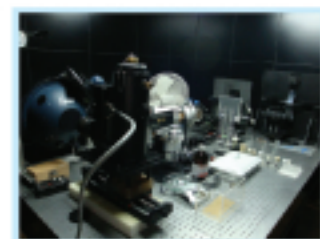
1. 多模态分子影像关键科学问题研究,国家重点基础研究973计划,2011-2015,700万(2650万)
2. 小动物在体自发荧光断层分子影像仪器设备,国家自然科学基金科学仪器基础研究专项,2011-2013,160万
3. 基于因果网络分析的针刺穴位特异性协同作用机制研究,国家自然科学基金面上项目,2011-2013,32万
4. 基于无网格方法的生物发光断层成像研究,国家自然科学基金面上项目,2011-2013,32万
5. 跨种族成人和儿童面孔加工神经机制的研究,海外及港澳学者合作研究基金,2011-2012,20万
6. 动态PET定量分析算法和血液函数自动提取算法研究,国家自然科学基金面上项目,2011,10万
7. 生物组织计算机光学三维成像理论与方法,北京市自然科学基金重点项目,2011-2013,40万
8. Jorge Ripoll, 中科院“外籍青年科学家计划”,2011.1-2011.12,26.5万
9. Metin Akay, 中科院“外国专家特聘研究员计划”,2011.1-2011.12,51.5万



中科院副院长阴和俊在院副秘书长谭铁牛陪同下视察智能医学平台



杨鑫副研究员在深圳高交会上介绍自主研发的低成本医疗设备



分子影像实验室



## 国际期刊论文 (2010)

- Hui Zhang, Xiaopeng Zhang, Yingshi Sun, Jiangang Liu, Wu Li, and Jie Tian\*. A Weighted-RV Method to Detect Fine-Scale Functional Connectivity during Resting State. *NeuroImage*, 2010, Publication on line, DOI: 10.1016/j.neuroimage.2010.10.051. (SCI IF: 5.739)
- Jiangang Liu, Jun Li, Hongchuan Zhang, Cory A Rieth, David E Huber, Kang Lee, and Jie Tian\*. Neural correlates of top-down letter processing. *Neuropsychologia*, Vol. 48, No. 2, pp. 636-641, 2010. (SCI IF: 4.345)
- Jiangang Liu, Jun Li, Cory A. Rieth, David E. Hubs, Jie Tian\* and Kang Lee\*. A dynamic causal modeling analysis of the effective connectivities underlying top-down letter processing. *Neuropsychologia*, Publication on Line, DOI:10.1016/j.neuropsychologia.2011.01.011. (SCI IF: 4.345)
- Lijun Bai, Jie Tian\*, Chongguang Zhong, Ting Xue, Youbo you, Zhenyu Liu, Peng Chen, Qiyong Gong, Lin Ai, Wei Qin, Jianping Dai, Yijun Liu\*. Acupuncture modulates temporal neural responses in wide brain networks: evidence from fMRI study. *Molecular Pain*, Vol. 6, pp. 73, 2010. (SCI IF: 4.19)
- Chenghu Qin, Shouping Zhu, and Jie Tian\*. New optical molecular imaging systems. *Current Pharmaceutical Biotechnology*, Vol. 11, No. 6, pp. 620-627, 2010. (SCI IF: 3.404)
- Wu Li, Jiangtao Liu, F. Skidmore, Y. Liu, Jie Tian\*, K. Li. White Matter Microstructure Changes in the Thalamus in Parkinson Disease with Depression: A Diffusion Tensor MR Imaging Study. *American Journal of Neuroradiology*, 2010, Publication on line, DOI: 10.3174/ajnr.A2195. (SCI IF: 3.296)
- Bo Zhang, Xiang Yang, Fei Yang, Xin Yang, Chenghu Qin, Dong Han, Xibo Ma, Kai Liu, and Jie Tian\*. The CUBLAS and CULA based GPU acceleration of adaptive finite element framework for bioluminescence tomography. *Optics Express*, Vol. 18, No. 19, pp. 20201-20214, 2010. (SCI IF: 3.278)
- Bo Zhang, Xin Yang, Chenghu Qin, Dan Liu, Shouping Zhu, Jinchao Feng, Li Sun, Kai Liu, Dong Han, Xibo Ma, Xing Zhang, Jianghong Zhong, Xiuli Li, Xiang Yang, and Jie Tian\*. A trust region method in adaptive finite element framework for bioluminescence tomography. *Optics Express*, Vol. 18, No. 7, pp. 6477-6491, 2010. (SCI IF: 3.278)
- Dong Han, Jie Tian\*, Shouping Zhu, Jinchao Feng, Chenghu Qin, Bo Zhang, and Xin Yang. A fast reconstruction algorithm for fluorescence molecular tomography with sparsity regularization. *Optics Express*, Vol. 18, No. 8, pp. 8630-8646, 2010. (SCI IF: 3.278)
- Kai Liu, Yujie Lv, Jie Tian\*, Chenhu Qin, Xin Yang, Shouping Zhu, Dong Han. Evaluation of the simplified spherical harmonics approximation in bioluminescence tomography through heterogeneous mouse models. *Optics Express*, Vol. 18, No. 20, pp. 20968-21002, 2010. (SCI IF: 3.278)
- Kai Liu, Jie Tian\*, Xin Yang, Yujie Lv, Chenghu Qin, Shouping Zhu, Xing Zhang. A fast bioluminescent source localization method based on generalized graph cuts with mouse model validations. *Optics Express*, Vol. 18, No. 4, pp. 3732-3745, 2010. (SCI IF: 3.278)
- Nunu Ren, Jimin Liang, Xiaochao Qu, Jianfeng Li, Bingjia Lu, and Jie Tian\*. GPU-based Monte Carlo simulation for light propagation in complex heterogeneous tissues. *Optics Express*, Vol. 18, No. 7, pp. 6811-6823, 2010. (SCI IF: 3.278)
- Xueli Chen, Xinbo Gao, Duofang Chen, Xiaopeng Ma, Xiaohui Zhao, Man Shen, Xiangsi Li, Xiaochao Qu, Jimin Liang, Jorge Ripoll, and Jie Tian\*. 3D reconstruction of light flux distribution on arbitrary surfaces from 2D multi-photographic images. *Optics Express*, Vol. 18, No. 19, pp. 19876-19893, 2010. (SCI IF: 3.278)
- Junting Liu, Yabin Wang, Xiaochao Qu, Xiangsi Li, Xiaopeng Ma, Runqiang Han, Zhenhua Hu, Xueli Chen, Dongdong Sun, Rongqing Zhang, Duofang Chen, Dan Chen, Xiaoyuan Chen, Jimin Liang, Feng Cao, and Jie Tian\*. In vivo quantitative bioluminescence tomography using heterogeneous and homogeneous mouse models. *Optics Express*, Vol. 18, No. 12, pp. 13102-13113, 2010. (SCI IF: 3.278)
- Xibo Ma, Zheofei Liu, Xin Yang, Shouping Zhu, Qiujuan Gao, Kai Liu, Chenghu Qin, Bo Zhang, Dong Han, Fan Wang\*, Jie Tian\*. Dual modality monitoring of tumor response to cyclophosphamide in mice with combined bioluminescence imaging and small-animal PET. *Molecular Imaging*, 2010, Publication on line, DOI: 2010.00041. (SCI IF: 2.786)
- Lijun Bai, Hao Yan, Jie Tian\*, Linling Li. Neural specificity of acupuncture stimulation at PC6: evidence from an fMRI study. *Journal of Magnetic Resonance Imaging*, Vol. 31, pp. 71-77, 2010. (SCI IF: 2.77)
- Jun Li, Jiangang Liu, Jimin Liang, Hongchuan Zhang, Jizheng Zhao, Cory A. Rieth, David E. Huber, Wu Li, Guangning Shi, Lin Ai, Jie Tian\*, and Kang Lee. Effective connectivities of cortical regions for top-down face processing: A dynamic causal modeling study. *Brain Research*, Vol. 1340, pp. 40-51, 2010. (SCI IF: 2.56)
- Heyu Huang, Xiaochao Qu, Jimin Liang, Xiaowei He, Xueli Chen, Da'an Yang, Jie Tian\*. A multi-phase level set framework for source reconstruction in bioluminescence tomography. *Journal of Computational Physics*, Vol. 229, No. 13, pp. 5246-5256, 2010. (SCI IF: 2.369)
- Dehui Xiang, Jie Tian, Fei Yang, Qi Yang, Xiang Zhang, Qingde Li, Xin Liu. Skeleton Cuts - An Efficient Segmentation Method for Volume Rendering. *IEEE Transactions on Visualization and Computer Graphics*, 2010, Publication on line, DOI: <http://doi.ieeecomputersociety.org/10.1109/TVCG.2010.239>. (SCI IF: 2.35)
- Jian Chen, Jie Tian\*, Noah Lee, Jian Zheng, R. Theodore Smith, and Andrew F. Laine. A partial intensity invariant feature descriptor for multimodal retinal image registration. *IEEE Transactions on Biomedical Engineering*, Vol. 57, No. 7, pp. 1707-1718, 2010. (SCI IF: 2.154)
- Xing Zhang, Jie Tian\*, Kexin Deng, Yongfang Wu, and Xiuli Li. Automatic Liver Segmentation Using a Statistical Shape Model with Optimal Surface Detection. *IEEE Transactions on Biomedical Engineering*, Vol. 57, No. 10, pp. 2622-2626, 2010. (SCI IF: 2.154)
- Junting Liu, Duofang Chen, Xiangsi Li, Xiaopeng Ma, Haichao Chen, Weiwei Fan, Fu Wang, Xiaochao Qu, Jimin Liang, Feng Cao, and Jie Tian\*. In vivo quantitative reconstruction studies of bioluminescence tomography: effects of peak wavelength shift and model deviation. *IEEE Transactions on Biomedical Engineering*, Vol. 57, No. 10, pp. 2579-2582, 2010. (SCI IF: 2.154)
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- Linling Li, Wei Qin, Lijun Bai, Jie Tian\*. Exploring vision-related acupuncture point specificity with multi-voxel pattern analysis. *Magnetic Resonance Imaging*, Vol. 28, No. 3, pp. 380-387, 2010. (SCI IF: 2.1)
- Jizheng Zhao, Jiangang Liu, Jun Li, Jimin Liang, Lu Feng, Lin Ai, Kang Lee, Jie Tian\*. Intrinsically organized network for word processing during the resting state. *Neuroscience Letters*, Vol. 487, No. 1, pp. 27-31, 2010. (SCI IF: 1.9)
- Jixin Liu, Wei Qin, Qian Guo, Jinbo Sun, Kai Yuan, Peng Liu, Yi Zhang, Karen M. von Deneen, Yijun Liu, Jie Tian\*. Distinct brain networks for time-varied characteristics of acupuncture. *Neuroscience Letters*, Vol. 468, No. 3, pp. 353-358, 2010. (SCI IF: 1.9)
- Kai Yuan, Wei Qin, Minghao Dong, Jixin Liu, Peng Liu, Yi Zhang, Jinbo Sun, Wei Wang, Yarong Wang, Qiang Li, Weichuan Yang, Jie Tian\*. Combining spatial and temporal information to explore resting-state networks changes in abstinent heroin-dependent individuals. *Neuroscience letters*, Vol. 475, No. 1, pp. 20-24, 2010. (SCI IF: 1.9)
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- Peng Liu, Guangyu Zhou, Yi Zhang, Minghao Dong, Wei Qin, Kai Yuan, Jinbo Sun, Jixin Liu, Jimin Liang, Karen M. von Deneen, Yijun Liu, and Jie Tian\*. The hybrid GLM-ICA investigation on the neural mechanism of acupoint ST36: an fMRI study. *Neuroscience Letters*, Vol. 479, No. 3, pp. 267-271, 2010. (SCI IF: 1.9)



31. Yanshuang Ren, Lijun Bai, Yuanyuan Feng, Jie Tian\*, Kuncheng Li\*, Investigation of acupoint specificity by functional connectivity analysis based on graph theory, *Neuroscience Letters*, Vol. 482, No. 1, pp. 95-100, 2010. (SCI IF: 1.9)
32. Kai Yuan, Wei Qin, Minghao Dong, Jixin Liu, Jinbo Sun, Peng Liu, Yi Zhang, Wei Wang, Yarong Wang, Qiang Li, Liyan Zhao, Karen M. von Deneen, Yijun Liu, Mark S. Gold, Jie Tian\*, Gray matter deficits and resting-state abnormalities in abstinent heroin-dependent individuals, *Neuroscience Letters*, Vol. 482, No. 1, pp. 101-105, 2010. (SCI IF: 1.9)
33. Kai Liu, Xin Yang, Dan Liu, Chenghu Qin, Junting Liu, Zhijun Cheng, Min Xu and Jie Tian\*. Spectrally resolved three dimensional bioluminescence tomography with a level set strategy. *Journal of the Optical Society of America A*, Vol. 27, No. 6, pp. 1413-1423, 2010. (SCI IF: 1.87)
34. Jian Zheng, Jie Tian\*, Kexin Deng, Xiaoqian Dai, and Min Xu. Salient Feature Region: a New Method for Retinal Image Registration. *IEEE Transactions on Information Technology in Biomedicine*, 2010, Publication on line, DOI: <http://dx.doi.org/10.1109/TITB.2010.2091145>. (SCI IF: 1.694)
35. Yakang Dai, Jie Tian\*, Jian Zheng, Guorui Yan, Real-time visualized freehand 3D ultrasound reconstruction based on GPU. *IEEE Transactions on Information Technology in Biomedicine*, Vol. 14, No. 6, pp. 1338-1345, 2010. (SCI IF: 1.694)
36. Guorui Yan, Jie Tian\*, Shouping Zhu, Chenghu Qin, Yakang Dai, Fei Yang, Di Dong, and Ping Wu. Fast Katsevich Algorithm Based on GPU for Helical Cone-Beam Computed Tomography. *IEEE Transactions on Information Technology in Biomedicine*, Vol. 14, No. 4, pp. 1053-1061, 2010. (SCI IF: 1.694)
37. Dong Han, Xin Yang, Kai Liu, Chenghu Qin, Bo Zhang, Xibo Ma, and Jie Tian\*. Efficient reconstruction method for L1 regularization in fluorescence molecular tomography. *Applied Optics*, Vol. 49, No. 36, pp. 6930-6937, 2010. (SCI IF: 1.41)
38. Xueli Chen, Xinbo Gao, Xiaochao Qu, Duofang Chen, Xiaopeng Ma, Jimin Liang, and Jie Tian\*, A generalized free-space diffuse photon transport model based on the influence analysis of camera lens diaphragm, *Applied Optics*, Vol. 49, No. 29, pp. 5654-5664, 2010. (SCI IF: 1.41)
39. Xiaoqian Dai, Jie Tian\*, and Zhe Chen. Performance evaluation of kinetic parameter estimation methods in

- dynamic FDG-PET studies. *Nuclear Medicine Communications*, Vol. 32, No. 1, pp. 4-16, 2011. (SCI IF: 1.315)
40. Eryun Liu, Jimin Liang\*, Liaojun Pang, Min Xie, Jie Tian. Minutiae and modified Biocode fusion for fingerprint-based key generation. *Journal of Network and Computer Applications*, Vol. 33, No. 3, pp. 221-235, 2010. (SCI IF: 1.111)
41. Peng Li, Xin Yang, Kai Cao, Xunqiang Tao, Ruifang Wang, Jie Tian\*. An Alignment-free Fingerprint Cryptosystem based on Fuzzy Vault Scheme. *Journal of Network and Computer Applications*, Vol. 33, No. 3, pp. 207-220, 2010. (SCI IF: 1.111)
42. Kai Cao, Xin Yang, Xunqiang Tao, Peng Li, Yali Zang, Jie Tian\*. Combining Features for Distorted Fingerprint Matching. *Journal of Network and Computer Applications*, Vol. 33, No. 3, pp. 258-267, 2010. (SCI IF: 1.111)
43. Di Dong, Jie Tian\*, Yakang Dai, Guorui Yan, Fei Yang and Ping Wu, Unified Reconstruction Framework for Multi-modal Medical Imaging. *Journal of X-Ray Science and Technology*, 2010 (in press). (SCI IF: 0.571)
44. Kexin Deng, Jie Tian\*, Jian Zheng, Xing Zhang, Xiaoqian Dai, and Min Xu. Retinal Fundus Image Registration via Vascular Structure Graph Matching. *International Journal of Biomedical Imaging*, 2010, Publication on line, DOI: <http://dx.doi.org/10.1155/2010/906067>. (EI)
45. Kuan Peng, Xinbo Gao, Jimin Liang, Xiaochao Qu, Nunu Ren, Xueli Chen, Bin Ma, and Jie Tian\*. Study on Photon Transport Problem Based on the Platform of Molecular Optical Simulation Environment. *International Journal of Biomedical Imaging*, Volume 2010, Article ID 913434, 9 pages, doi: 10.1155/2010/913434, 2010. (EI)
46. Xueli Chen, Xinbo Gao, Xiaochao Qu, Duofang Chen, Bin Ma, Lin Wang, Kuan Peng, Jimin Liang, Jie Tian\*. Qualitative Simulation of Photon Transport in Free-Space Based on Monte Carlo Method and Its Parallel Implementation. *International Journal of Biomedical Imaging*, 2010, Volume 2010, Article ID 650298, 9 pages doi: 10.1155/2010/650298, 2010. (EI)
47. Xiaowei He, Jimin Liang, Xiaochao Qu, Heyu Huang, Yanbin Hou, Jie Tian\*. Truncated Total Least Squares-Method with a Practical Truncation Parameter Choice Scheme for Bioluminescence Tomography Inverse Problem. *International Journal of Biomedical Imaging*, Volume 2010, Article ID 291874, 11 pages, doi:10.1155/2010/291874, 2010. (EI)

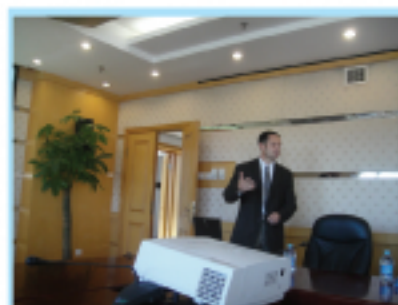
## 授权国家发明专利

1. 一种基于模式识别分类提取磁共振成像脑激活区的方法, 专利号: ZL200710098691.3, 2010年1月
2. 基于奇异点拓扑结构的快速指纹识别方法, 专利号: ZL200610112936.9, 2010年1月
3. 一种基于方向场模型和 Gabor 滤波器指纹合成方法及系统, 专利号: ZL200610113241.2, 2010年1月
4. 一种基于三维纹理硬件加速的海量数据体绘制方法, 专利号: ZL200710065336.6, 2010年2月
5. 一种基于指纹频域的数字信息或密钥绑定与发布方法, 专利号: ZL200710062826.0, 2010年2月
6. 一种多模态自发荧光断层分子影像仪器及重建方法, 专利号: ZL200710099044.4, 2010年4月
7. 一种基于自适应有限元的多光谱重建方法, 专利号: ZL200710098464.0, 2010年6月

## 申请发明专利

1. A Specificity-Based Imaging System for Multimodality Three-Dimensional Optical Tomography, 受理号: PCT/CN2010/001930, 2010年11月
2. An approach to Cerenkov Luminescence Tomography Imaging, 受理号: PCT/CN2010/002141, 2010年12月
3. 一种激发荧光断层成像的仿真平台和快速稀疏重建方法, 受理号: 201010573795.7, 2010年11月

## 部分学术交流活动



美国 Kitware 公司 Dr. S.R. Aylward 来访



美国 NIH R.M. Summers 教授来访



973 分子影像总结与验收报告会



西班牙 Pompeu Fabra 大学  
Frangi 教授来访



希腊 Forth 大学 Jorge Ripoll 教授来访



美国 Stanford 大学 Gambhir 教授来访