自动化

图像处理技术在直升机巡检输电线路中的应用综述

仝卫国 苑津莎 李宝树

华北电力大学，河北省 保定市 071003

摘要： 直升机巡检以其高效、准确和安全等特点逐渐成为高压输电线路巡检的重要方式。通过对直升机巡检采集到的大量航拍图像的处理和分析可以发现输电线路故障和缺陷，因此图像处理技术在电力线路巡检中具有良好的应用前景。分析了国内外直升机巡检输电线路图像处理技术的研究现状，提出了图像处理技术应用于该领域需要解决的几个主要技术问题，并探讨了可能的解决方案，最后对输电线路巡检的发展方向进行了预测,并提出该领域将可能成为研究热点。

关键词：

Application of Image Processing in Patrol Inspection of Overhead Transmission Line by Helicopter

TONG Weiguo ,YUAN Jinsha ,LI Baoshu

North China Electric Power University, Baoding 071003, Hebei Province, China

Abstract: Due to its features such as high efficiency, accuracy and safety, patrol inspection by helicopter evolves as an important inspection manner for high voltage overhead transmission lines. Through the processing and analysis on lots of aerial photographs acquired by patrol inspection with helicopter, the faults and defects of transmission lines can be found, so there is a good application prospect of image processing technology in patrol inspection of overhead transmission lines. Present research situation of applying image processing to patrol inspection of overhead transmission lines by helicopters home and abroad is analyzed, and main technical problems to be solved in the field of applying image processing technology to this field are put forward, and possible solutions are discussed. Finally, the development trend in this field is prospected.

Keywords:

通讯作者: 仝卫国

作者简介：

作者Email: twg1018@163.com

参考文献：

[1] 张柯，李海峰，王伟．浅谈直升机作业在我国特高压电网中的应用[J]．高电压技术，2006，32(6)：45-55． Zhang Ke，Li Haifeng，Wang Wei．Analysis of helicopter patrol application prospect in China's UHV grid[J]．High Voltage Engineering，2006，32(6)：45-55(in Chinese)． [2] 于德明，沈建，汪骏，等．直升机在电网运行维护中的研究与应用[J]．电网技术，2009，33(6)：107-112． Yu Deming，Shen Jian，Wang Jun，et al．Research and application of helicopter in patrol and hotline operating maintenance of power lines [J]．Power System Technology，2009，33(6)：107-112(in Chinese)． [3] 李国兴．我国直升机电力作业的现状与发展[J]．电力设备，2006，7(3)：41-45． Li Guoxing．Present situation and development of helicopter power job in China[J]．Electrical Equipment，2006，7(3)：41-45(in Chinese)． [4] Ma Lili，Chen Yangquan．Aerial surveillance system for overhead power line inspection[R]．Center for Self-organizing and Intelligent Systems (CSOIS)，USA，Utah，2003． [5] Jones D I．Aerial inspection of overhead power lines using video：estimation of image blurring due to vehicle and camera motion[C]//IEE Proceedings of Vision，Image，and Signal Processing．UK：IEE Proceedings of Vision，Image，and Signal Processing，2000：157-166． [6] Jones D I，Earp G K．Camera sightline pointing requirements for aerial inspection of overhead power lines[J]．Electric Power Systems Research，2001，57(2)：73-82． [7] Ian Golightly，Dewi Jones．Corner detection and matching for visual tracking during power line inspection[J]．Image and Vision Computing，2003，21

(9)：827-840． [8] 李朝阳，阎广建，肖志强，等．高分辨率航空影像中高压电力线的自动提取[J]．中国图象图形学报，2007，12(6)：1041-1046． Li Chaoyang，Yan Guangjian，Xiao Zhiqiang，et al．Automatic extraction of power lines from aerial image[J]．Journal of Image and Graphic，2007，12(6)：1041-1046(in Chinese)． [9] Tong Weiguo，Li Baoshu，Yuan Jinsha，et al．Transmission line extraction and recognition from natural complex background[C]// Proceedings of the Eighth International Conference on Machine Learning and Cybernetics．Baoding，China：IEEE Systems，Man and Cybernetics Society，2009：2473-2477． [10] Kamal Sarabandi，Moonsoo Park．Extraction of power line maps from millimeter-wave polarimetric SAR images[J]．IEEE Transactions on Antennas and Propagation，2000，48(12)：1802-1809． [11] Li Zhengrong，Liu Yuee，Ross Hayward，et al．Knowledge-based power line detection for UAV surveillance and inspection systems[C]// IEEE Conference on Image and Vision Computing．New Zealand：IEEE，2008：1-6． [12] 黄宵宁，张真良．直升机巡检航拍图像中绝缘子图像的提取算法[J]．电网技术，2010，34(1)：194-197． Huang Xiaoning，Zhang Zhenliang．A method to extract insulator image from aerial image of helicopter patrol[J]．Power System Technology，2010，34(1)：194-197(in Chinese)． [13] 徐青松，季洪献，王孟龙．输电线路弧垂的实时监测[J]．高电压技术，2007，33(7)：206-209． [14] Ishino R，Tsutsumi Dr F．CRIEPI's aerial inspection of transmission conductor[J]．Transmission & Distribution World，2004(12)：52-55． [15] Li Junfang，Li Baoshu，Zhao Shutao．A measuring method for transmission line sag based on computer vision[C]//Sustainable Power Generation and Supply Conference Provisional Proceedings．Nanjing，China：UK-China Network of Clean Energy Research，2009：1-5． [16] 张吴明，杨又华，阎广建，等．机载多角度多光谱成像技术在电力系统中的应用[J]．华中电力，2006，19(6)：1-3． Zhang Wuming，Yang Youhua，Yan Guangjian，et al．Application of airborne multiangular and multispectral imaging system in power system[J]．Central China Electric Power，2006，19(6)：1-3(in Chinese)． [17] Zhang Zhengyou．A f1exible new technique for camera calibration[J]．IEEE Transactions on PAMI，2000，22(11)：374-376． [18] Zhao Zhenbing，Yuan Jinsha，et al．Wavelet image de-noising method based on noise standard deviation estimation[C]//Proceedings of 2007 International Conference on Wavelet Analysis and Pattern Recognition．Beijing，China：IEEE Systems，Man and Cybernetics Society，2007：1910-1914． [19] 高强，赵振兵，李然，等．基于独立分量分析的近红外图像去噪方法的研究与应用[J]．中国电机工程学报，2005，25(22)：94-98． Gao Qiang，Zhao Zhenbing，Li Ran，et al．Reaseach and its application of a method of near-infrared image de-noising based on ICA[J]．Proceedings of the CSEE，2005，25(22)：94-98(in Chinese)． [20] 杨森，董吉文，鲁守银．变电站设备巡检机器人视觉导航方法[J]．电网技术，2009，33(5)：12-16． Yang Sen，Dong Jiwen，Lu Shouyin．Visual navigation method of substation patrol robot[J]．Power System Technology，2009，33(5)：12-16(in Chinese)． [21] 孙凤杰，崔维新，张晋保，等．远程数字视频监控与图像识别技术在电力系统中的应用[J]．电网技术，2005，29(5)：81-84． Sun Fengjie，Cui Weixin，Zhang Jinbao，et al．Application of remote digital video supervisory and image recognition technology for power system[J]．Power System Technology，2005，29(5)：81-84(in Chinese)． [22] Chen Dezhi，Qin Qiming，Du Shihong，et al．Extracting road from high-resolution satellite images with the combination of automatic and semi-automatic methods[C]//Geoscience and Remote Sensing Symposium．Seoul，Korea：IEEE Geoscience and Remote Sensing Society，2005：3880-3883． [23] 黄睿，杨少军，何明一．航空遥感图象中道路的自动提取方法[J]．计算机工程与应用，2004，40(34)：218-221． Huang Rui，Yang Shaojun，He Mingyi．Automatic road extraction from aerial remote sensing images[J]．Computer Engineering and Applications，2004，40(34)：218-221(in Chinese)． [24] 葛玉敏．基于计算机视觉的绝缘子状态检测[D]．保定：华北电力大学，2006． [25] 李佐胜，姚建刚，杨迎建，等．基于方差分析的绝缘子红外热像特征选择方法[J]．电网技术，2009，33(1)：92-96． Li Zuosheng，Yao Jiangang，Yang Yingjian，et al．Feature selection method of insulator infrared thermal image based on variance analysis[J]．Power System Technology，2009，33(1)：92-96(in Chinese)． [26] 章毓晋．图像工程(下册)：图像理解[M]．北京：清华大学出版社，2006：103-147．

本刊中的类似文章