Atul Kumar MBBS MMST PhD

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ECFMG certification number: 0-710-213-0 **USMLE Step1-80(196) Step2-79(196) Step3-77(197)**

SUMMARY OF QUALIFICATIONS

- Multi-disciplinary background in **Biomedical Engineering and Medicine**
- Experienced in research for **computer assisted surgery and computer assisted diagnosis**

EDUCATION

Cleveland State University, Cleveland, OH **2007-2011**
Doctor of Engineering: Applied Biomedical Engineering
Dissertation topic: Design of an implant for the first metatarsophalangeal joint hemiarthroplasty.

Indian Institute of Technology, Kharagpur, India **2004- 2007**
MMST (Master of Medical Science and Technology)

Patna Medical College, Patna, India **1996- 2002**
MBBS (Bachelor of Medicine and Bachelor of Surgery)

RESEARCH AND EMPLOYMENT EXPERIENCE

Research Fellow
Asian Institute of Telesurgery, IRCAD-Taiwan R.O.C **Oct 2011- Present**

Current:

- Metric 3D reconstruction from colonoscopic images
  - Image processing and computer vision algorithms are used to create a 3D virtual model from endoscopic images
- Augmented reality during endoscopic surgery
  - Computer vision algorithm based as well as electromagnetic tracker based systems are under development for enhancing the endoscope view with the 3D virtual model of patient's body.

Past:

- Stereoscopic visualization during Minimally Invasive Surgery
  - Computer vision algorithm and GPU programming were used to make software for converting conventional endoscope video to stereo video in near real-time.
- Panoramic view during laparoscopy
  - Software for creating 2D and 3D panorama view with the superimposed current video scene during the endoscopic surgery was developed.
- Characterization of liver tumors in CT image
  - Hepatocellular carcinoma architecture in the CT scan images was characterized with texture analysis and machine learning algorithms to detect hepatocellular carcinoma regions in CT scan images.

- Characterization of pulmonary edema in radiographs
    - Chest x-ray with pulmonary edema of various degrees was distinguished from normal chest x-ray using texture analysis and machine learning algorithms.

Visiting Scientist **Nov 2008- Sept 2011**
University of Washington, Seattle, WA

- Design of an implant for 1st metatarsophalangeal joint
    - First metatarsophalangeal joint morphology was characterized using its 3D virtual model acquired with laser scanner. Implants of various sizes were designed based on the 3D structure of the joint, using optimization and computational geometry techniques.
- Cartilage thickness measurement in MRI images
    - Cartilage region in 14T MRI images of first metatarsal head was segmented and its thickness profile in three dimensions was measured, using image processing and computational geometry techniques.

Research Assistant
Cleveland Clinic, Cleveland, OH **Oct 2007-Oct 2008**

- Design of an implant for 1st metatarsophalangeal joint
    - Acquisition of 3D surface image of 1st metatarsal and phalanx bones using 3D laser scanner was done. A study protocol for the design of 1st metatsophalangeal joint implant was designed.

Junior Specialist
University of California, San Francisco, CA **May 2006 - Oct 2006**

- Study of auditory feedback processing in brain
    - Acquisition of magnetoencephalographic and MRI data, and its analysis was done to investigate auditory feedback.

General Practitioner **July 2004 - May 2006**
B.C.Roy Technology Hospital, Kharagpur, India

- Management of patients in clinics, wards and emergencies of the Hospital.

Trainee **May 2005- July 2005**
All India Institute of Medical Sciences, Delhi, India

- Assisted in collecting and analyzing MRI and MR spectroscopy data for quantification of metabolites in motor area of brain during activation.

Junior Resident
Patna Medical College, Patna, India **Nov 2003- July 2004**

- Management of patients in clinics, wards and emergencies in the department of Ophthalmology.

General Practitioner **April 2003-Nov 2003**
Patna, India (self-employed)

- Management of patients in clinics.

Internship **Mar 2002- Mar 2003**
Patna Medical College Hospital, Patna, India

- Management of patients in the departments of medicine, surgery, obstetrics gynecology, family planning, public health and preventive medicine.
- Educating health and hygiene to the public during health camps.

PUBLICATIONS/PRESENTATIONS

- Yu-Chieh Lin, Jiunn-Lin Wu, I-Chun Lee, 2Chi-Hsiang Wu, **Atul Kumar**, Kai-Che Jack Liu and Yen-Yu Wang CT Image Segmentation with Supervised Clustering Using Hierarchical Support Vector Machines. International Journal of Computer, Consumer and Control (IJ3C), Vol. 5, No.2 (2016)
- Yen-Yu Wang, **Atul Kumar,** Kai-Che Liu, Shih-Wei Huang, Ching-Chun Huang, Wei-Chia Su, Wen-Nung Lie. "Stereoscopic Augmented Reality for Single Camera Endoscopy: A Virtual Study" Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization (15 Jul 2016)
- **Atul Kumar,** Wen-Chen Tsai, Tai-Sheng Tan, Li-Ting Chiu, Pei-Tseng Kung, Ching-Kan Lo, Ming-Chou Ku. "Risk of Post-TKA Acute Myocardial Infarction in Patients With a History of Myocardial Infarction or Coronary Stent" Clinical Orthopaedics and Related Research 2016 Feb;474(2):479-86..
- **Atul Kumar**, Tai-Sheng Tan, Wen-Chen Tsai, Li-Ting Chiu, Peichen Kung, Ming-Chou Ku. "Temporal Trends in Total Knee and Hip Replacement in Taiwan." Journal of Chinese Medical Association 2015 Sep;78(9):538-44.
- **Atul Kumar**, Yen-Yu Wang, Ching-Jen Wu, Kai-Che Liu, and Hurng-Sheng Wu. "Stereoscopic visualization of laparoscope image using depth information from 3D model." Computer methods and programs in biomedicine 113, no. 3 (2014): 862-868.
- **Atul Kumar** , Brian Donley, and Peter R. Cavanagh. "Design of an implant for first metatarsophalangeal hemi-arthroplasty." Computer methods in biomechanics and biomedical engineering 17.16 (2014): 1777-1784.
- **Atul Kumar**, Joe-Mingchou Ku, Yanyu Chen, Weijen Chen, Chiensheng Lo, "Evolution of Minimally Invasive Total Knee Arthroplasty." (2013, December) Medical Journal of Show Chwan Memorial Health System, Taiwan.
- Atul Kumar, Shih-Wei Huang, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Yi-Chun Lee,Jungle Chi-hsiang Wu, Jian Hua Lin "Real to virtual scene registration using Kinect® for endoscopic augmented reality system" (March 2017) Society of American Gastrointestinal and Endoscopic Surgeons, Boston, USA
- Shih-Wei Huang, Yen-Yu Wang, Wan-Chi Hung, Atul Kumar, Kai-Che Liu, Jian-Hua Lin, Jing-Jim Ou, Tt Chung,"2D to 3D conversion of conventional endoscopic video: A preliminary result" (March 2017) Society of American Gastrointestinal and Endoscopic Surgeons, Boston, USA.
- Atul Kumar, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Shih-Wei Huang, Ching-Chun Huang, Yi-Chun Lee, "Laparoscopic video augmentation with infrared image information" (July 2016) IEEE International Conference on Consumer Electronics, Taipei, Taiwan.
- Atul Kumar, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Shih-Wei Huang, Ching-Chun Huang,

Yi-Chun Lee "Segmented near infrared light image superimposition on visible light endoscopic video for gall bladder surgery" (June 2016) Computer Assisted Radiology and Surgery, Heidelberg, Germany

- Kumar Atul, Shih-Wei Huang, Wang Yen Yu, Liu Kai-Che, Wu, Huang Ching-Chun, Lee Yi-Chun, Ou Jing-Jim, Hung Wan-Chi "3D structure reconstruction of lesions in colon with colonoscopic images" (March 2016) Society of American Gastrointestinal and Endoscopic Surgeons, Boston, USA
- Wang Yenyu, Yeh Tien-Shou, Kumar Atul, Hung Wan Chi, Su Wei-Chia, Liu Kai-Che, Wu, Hurng-Sheng "3D endoscope system of monoscopic endoscope with external stereo lens" (March 2016) Society of American Gastrointestinal and Endoscopic Surgeons, Boston, USA
- Atul Kumar, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Shih-Wei Huang, Wen-Nung Lie, Ching-Chun Huang, "Surface reconstruction from endoscopic image sequence" (July 2015) IEEE International Conference on Consumer Electronics, Taipei, Taiwan.
- Atul Kumar, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Shih-Wei Huang, Wen-Nung Lie, Ching-Chun Huang. "Three dimensional panorama visualization for endoscopic video: A shape from shading approach." (May 2015) World Congress on Bioengineering, Singapore
- Atul Kumar, Yen-Yu Wang, Kai-Che Liu, Wan-Chi Hung, Shih-Wei Huang, Wen-Nung Lie, Ching-Chun Huang. "Stereoscopic Augmented Reality for Single Camera Endoscope Using Optical Tracker: A Study on Phantom" (September 2015) Third International Conference on Robot, Vision and Signal Processing, Kaoshiung, Taiwan
- **Atul Kumar**, Kai-Che Liu, Ching-Chun Huang, Ming Hsun LeeLihsun , Chen, Yen-Yu Wang, Hurng-Sheng Wu. Hepatocellular carcinoma detection in arterial phase of CT using directional features and machine learning algorithm. (**2014, November**) at Radiological Society of North America, Chicago, USA
- **Atul Kumar**, Ching-Chun Huang, Nguyen Hung,Yen-Yu Wang, Ching-Jen Wu, Kai-Che Liu, I-Chen Tsai. Distinguishing normal and pulmonary edema chest x-ray using Gabor filter and SVM-A preliminary report. (**2014, April**) at 2014 IEEE International Symposium on Bioelectronics and Bioinformatic; Taiwan.
- **Atul Kumar**, Ching-Jen Wu, Kai-Che Liu, Yen-Yu Wang, Hurng-Sheng Wu. Stereoscopic Laparoscopy Using Depth Information from 3D Model. (**2014, April**) at 2014 IEEE International Symposium on Bioelectronics and Bioinformatics; Taiwan.
- **Atul Kumar**, Ching-Jen Wu, Yen-Yu Wang, Kai-Che Liu and Hurng-Sheng Wu. Dynamic field view expansion of the laparoscope video using robot arm. (**2013,September**) at Asian Conference on Computer Aided Surgery 2013; Tokyo, Japan.
- **Atul Kumar**, Ching-Jen Wu,Kai-Che Liu, Yen-Yu Wang, Hurng-Sheng Wu. Augmented reality for laparoscopy surgery using registration and image feature tracking. (**2013,September**) at Asian Conference on Computer Aided Surgery 2013; Tokyo, Japan.
- Ching-Chun Huang , Nguyen Manh Hung, and **Atul Kumar**. A Hybrid Method for 3D Instrument Reconstruction and Tracking in Laparoscopy Surgery. (**2013, November**) at International Conference on Control, Automation and Information Sciences 2013 (IEEE Conf. No. 31270); Ho Chi Minh City, Vietnam.
- Kai-Che Liu, **Atul Kumar**, Leona Chen, Yen-Yu Wang, Hurng-Sheng Wu, Min-Ho Huang. 3D Visualization of Laparoscopic Images by Registration to 3D CT/MRI Model. (**2013, December**) at Radiological Society of North America; Annual Meeting 2013, Chicago, USA.

- **Atul Kumar**, Ching-Jen Wu, Kai-Che Liu, Yen-Yu Wang, Anant S. Vemuri; Ming-Chou Ku; ChiHsiang Wu; Hurng-Sheng Wu. Robot arm controlled dynamic field view expansion of the endoscope video. (**2013, July**) at IEEE Conference on Computer Vision and Pattern Recognition 2013; Portland, Oregon, USA
- **Atul Kumar**, Tai-Sheng Tan, Wen-Chen Tsai, Li-Ting Chiu, Peichen Kung, Ming-Chou Ku. Temporal Trends in Total Knee and Hip Replacement in Taiwan. (**2012, October**) at Annual meeting of Taiwan Orthopedic Association 2012; Taipei, Taiwan
- **Atul Kumar**, Donghoon Lee, Peter R. Cavanagh. Measurement of MTPJ cartilage thickness distribution using 14T MRI. (**2012, August**) at American Society of Biomechanics 2012; Gainesville, Florida.
- **Atul Kumar**, Kai-Che Liu, Yen-Yu Wang, Hurng-Sheng Wu. Stereoscopic visualization of monoscopic laparoscopy image by registration to the rendered image. (**2012, May**) at World Congress on Medical Physics and Biomedical Engineering; Beijing, China.
- **Atul Kumar**, Brian Donley, and Peter R. Cavanagh. Design of a 1st Metatarsophalangeal Hemi-Arthroplasty Implant Based on Morphological Data. (**2010, September**) at International society of foot and ankle biomechanics; Seattle, WA.
- **Atul Kumar**, Brian Donley, and Peter R. Cavanagh. Design of a 1st Metatarsophalangeal Hemi-Arthroplasty Implant Based on Morphological Data**.** (**2010, August**) at American Society of Biomechanics; Providence, RI.

PATENTS

- A system and method for monoscopic endoscope with adapter lens to capture stereo image (Application in Process)
- Stereo endoscope using shape from shading algorithm (European Patent number : 15180882; Taiwan patent application No. 103104853)
- A device for converting 2D endoscope video to stereo video. (Taiwan patent No. M467436)
- Infra-red rays based vein viewing device (Taiwan provisional patent No. 61/891,543)

GRANTS

- Public (PI): NT$800,000 from National Science Council, Taiwan for *3D reconstruction from endoscope images* **2016-2017**
- Private (co-PI): NT$281,000 from Show Chwan Memorial Hospital for *Lymph node identification using infrared image during endoscopy* **2015-2016**
- Private (co-PI): NT$281,000 from Show Chwan Memorial Hospital for *A Software for geometrical measurements on the 2D and 3D medical images.* **2015-2016**
- Private (co-PI): NT$281,000 from Show Chwan Memorial Hospital for *Evaluation of 3D stereo endoscope* **2015-2016**
- Public (PI): NT$ 400,000 from National Science Council, Taiwan for *Augmented reality system for laparoscopy*. **2014-2015**
- Private (PI): NT$282,000 from Show Chwan Memorial Hospital for *Augmented reality during endoscopy* **2013-2014**
- Private (PI): NT$281,000 from Show Chwan Memorial Hospital for *Texture Analysis of Chest X-ray* **2012-2013**

HONORS

- Taiwan National Innovation Award, Taipei, Taiwan R.O.C **2016**
- Taiwan National Innovation Award, Taipei, Taiwan R.O.C **2015**
- Graduate Research Assistantship, Cleveland State University, Cleveland **2007- 2011**
- Doctoral Dissertation Fellowship Award, Cleveland State University, Cleveland **2011**
- Graduate Assistantship, Indian Institute of Technology-Kharagpur, India **2004-2007**
- Secretary of National Medicos Organization, Patna, India **2000-2001**

COMPUTER SKILLS

- Programming languages and tools: C++, MATLAB, C#, C, Python
- Toolbox and libraries: MATLAB (Image processing, Optimization, Machine Learning, Computer vision, Computational Geometry, Compiler), C/C++ (Qt,VTK, OpenCV, ITK,PCL)
- Statistics tool: R, SPSS, Excel
- Shell scripting: Bash
- Operating Systems: **Linux, Windows, Macintosh**

CITIZENSHIP/VISA STATUS

- **Citizenship:** Indian
- **Visas**: Taiwan resident visa (Valid till September 2017), B1 for US (valid till Nov 2021).