Hyunggi Chang

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Education

- **Imperial College London** — London, UK
  M.Res. in Medical Robotics and Image-Guided Intervention; ***Merit*** — *Oct. 2017 – Sept. 2018*
- **University of Warwick** — Coventry, UK
  B.Eng. in Manufacturing and Mechanical Engineering; ***GPA (4.34/4,50)*** — *Oct. 2014 – Jun. 2017*

Research Experiences

- **Cavendish Laboratory, University of Cambridge** — Cambridgeshire, UK
  Visiting Researcher, Advisor: Dr. Sarah Bohndiek — *Jan. 2019 - Mar. 2019*
  - 3.5D hyperspectral point cloud generation, using Structure from Motion (SfM) and spectral-spatio-matching.
  - Wide-field multi-fibre endoscopic imaging device simulation.
- **Surgical Imaging and Biophotonics Laboratory, Imperial College London** — London, UK
  M.Res Student Researcher, Advisor: Prof. Daniel Elson — *Jan. 2018 - Sept. 2018*
  - Real-time vision-based surgical tool tracking and augmented reality visualisation.
  - Real-time biomedical spectroscopic data classification using machine learning.
- **HARMS Lab, Imperial College London** — London, UK
  M.Res Student Researcher, Advisor: Dr. George Mynolas — *Oct. 2017 - Dec. 2017*
  - Hand motion transfer to robotic movements in surgical scenarios.
  - Design improvements of an endoscopic robot.
- **Trace Metals in Medicine Laboratory, University of Warwick** — Coventry, UK
  B.Eng Student Researcher, Advisor: Dr. Joanna Collingwood — *Oct. 2016 - Jun. 2017*
  - Design of an educational MRI phantom for deliberate artifact generation.
- **International Institute for Product and Service Innovation, WMG** — Coventry, UK
  B.Eng Student Researcher, Advisor: Mr. Graeme Knowles — *Oct. 2016 - Jun. 2017*
  - Qualitative study in quality engineering techniques.

Work Experiences

- **VIRNECT** — Seoul, South Korea
  Computer Vision Research Engineer — *Apr. 2019 - Present*
  - Research and develop geometric vision algorithms for augmented reality applications.
- **McKinsey & Company** — New York, USA
  Student Analyst — *Oct 2017 - Dec 2017*
  - Market analysis and forecast of commercial robot and artificial intelligence technology.
  - Taught McKinsey business consultants on robotics industry.
- **CACTUS Communications** — London, UK
  Freelance Translator — *Oct. 2016 - Jun. 2018*
  - Translated MS/PhD thesis and papers from Korean to English and vice-versa on various engineering fields.

Skills

- **Languages :** Korean (Native), English (Bilingual)
- **Programming :** C, C++11/14, MATLAB, Python
- **Computer Vision :** OpenCV, Eigen, Ceres-solver, FFmpeg, Dlib, PyTorch, OpenVINO, MeshLab
- **Camera :** Intel RealSense, MS Kinect, Stereolabs ZED, FLIR Spinnaker, Optitrack Motive
- **Prototype :** SolidWorks, AutoCAD, AlphaCAM, 3D Printer, Laser cutter, Core workshop machines
- **Collaborative Development :** Git, GTest, Clang-format, Doxygen, JIRA, Slack, TeamCity
- **Other :** Rpi, Arduino, Nvidia Jetson, ROS, AirSim, ABB Robot Studio, CMake, LaTeX
- **Next 6 months :** CUDA, TensorRT, ONNX, PCL

Projects

- **SLAM to Replace Light Probe**
  - Semi-dense SLAM that is aware of light-sources to create an environmental cube map for ray-tracing.
- **VIRNECT AR SDK**
  - Generation of test data and ground-truth data, using AirSim and Optitrack Motion Capture.
  - Evaluation and validation of image tracking and SLAM algorithms with automatic report generation.
  - GTest for software quality assurance of vision algorithms.
- **Real-Time Welding Guidance using Augmented Reality**
  - Tracking of welding torch and HMD using fiducial markers and IMU under extreme light condition.
- **Marker-based Tool Tracker on Tabletop Scenario and Novel Multi-Camera Calibration Method**
  - Multi-view tool tracking using Perspective-n-Points (PnP) Algorithm with optimisation for minimal reprojection error.
  - Auto-calibration of camera extrinsics and the geometric relationship of marker-to-tooltip.
- **Building IR Motion Capture System with IMU, F/T, Video Genlock**
  - System setup of motion/dynamics capture system using Optitrack IR cameras, RGB cameras, IMU, and force/torque sensors on perfect time sync.
- **Affordable Hyperspectral Imaging System**
  - System setup of an affordable hyperspectral imaging rig, using light-sources of various spectral bands.
- **Omni-directional RGB-D Camera**
  - Real-time omni-directional RGB-D imaging, using multiple RGB-D Cameras.
- **Mobile Rover for Environment Mapping and Survivor Detection in Disaster Scenarios**
  - Voice-controllable rover, using RGB-D SLAM, object detection, and collision-avoidance.
  - Award winning project at MODU Embedded AI Hackathon.
- **Structure from Motion with Dynamic Objects**
  - Attempt to extract static map from dynamic scene, using only epipolar constraints.
- **Snapchat-like Face Filters**
  - Spot-removal filter, AR Kawaii-filter, Emotion masks, and Panda-face filter, using OpenCV and Dlib.
- **Make Surgical Scenes Less Disturbing**
  - Reduced visual discomfort in surgical scenes via neural-style algorithm and frame buffer.
- **Surgical Cobot Control with Gaze Control and QR Code Commands**
  - A concept code to use cobots in surgical theatre to pick up and pass tools to surgeons
- **Depth Mapping and Visualisation using Multiple Webcams**
  - Real-time depth map generation using affordable webcams.
- **A Real-Time Intraoperative Data Mapping Device for Probe-Based Measurements**
  - Customised optical biopsy system, using diffuse reflectance spectroscopy.
  - Multi-camera configuration for vision-based surgical instrument tracking.
  - Design ergonomic control and visualisation hardware and system.
- **Intraoperative Tissue Classification using Hyperspectral Sensing**
  - Cancer identification from optical spectroscopic data, using machine learning.
- **Vision-Based Endoscopic Navigation Using SLAM**
  - Monocular visual SLAM on a rigid colon phantom.
- **Motion Capture for Optimisation of Endoscopic Robot for Bi-Manual Suturing**
  - Hand motion transfer from a surgeon to a surgical robot, using Optitrack and ATI F/T.
  - Exploit and optimise the robot's mechanical configuration, based on required motion trends

- **Robotic Path Planning for Beating Heart Surgery**
  - MATLAB simulation for inverse kinematics of a PUMA robot on dynamic trajectory.
- **Development of modular training phantom for MRI radiologists**
  - Product development study for maximum customer satisfaction.
  - An educational MRI phantom for deliberate image artifact generation
- **Analysis of Industry 4.0 Manufacturing System Architecture on Quality Perspective**
  - Literature review of technological advances on Industry 4.0.
- **Text Writing Robot**
  - ABB robot programming to convert text into physical writing.

Patents

- **Calibration Mechanism and Method for Posture Estimation of Augmented Reality Guide Tool**
  - [PENDING] *T.J.Ha,* ***H.G.Chang****, S.H.Kim* - Ref Num: TP191060
- **Method and System for Posture Estimation about Object Tracking Taken by Camera**
  - [PENDING] *T.J.Ha,* ***H.G.Chang****, S.H.Kim, N.Y.Park* - Ref Num: TP191091

Leadership

- **Community Leader** - Kakao Community "We will be SLAM Masters" **2019**
- **Community Admin** - Facebook Community "AI Robotics KR" **2019**
- **Lead Student Ambassador** - Hamlyn Robotic & AI Summer School **2018**
- **Journal Club Lead** - Imperial College London **2018**
- **Lead Student Researcher** - McKinsey & Company **2017**
- **Course Representative** - Imperial College London **2017**
- **Course Representative** - University of Warwick **2016**

Teaching

- **Fundamentals of Simultaneous Localisation and Mapping - ORB-SLAM** Seoul, South Korea
  'We will be SLAM masters' study group *Nov. 2019 – PRESENT*
  - Organised and led 2-months study on Modern C++ and fundamentals of SLAM.
  - Leading 2-months course on in-depth review of ORB-SLAM and its source code.
- **Medical Imaging and Image-Guided Intervention** Seoul, South Korea
  MODU Labs - Flipped Learning Scheme *Oct.2019 – Dec.2019*
  - Taught on 11-weeks course on fundamentals of medical imaging and image-guided intervention.
  - X-ray, CT, Ultrasound, Nuclear Medicine, MRI, Microscopy, Fluorescence Imaging, Image-Guided Intervention.

Talks

- **MODUCON 2019** 2019
  - Design considerations for robust computer vision systems
  - Development strategies for Deep Learning
- **AI Robotics KR - The First** 2019
  - Camera hardware choices for robust computer vision systems
- **PyCon APAC 2019** 2019
  - Lightning Talk - Robot development with Python
- **NVIDIA Jetson Meetup** 2019
  - NVIDIA Jetson Nano for intelligent robot development