Ricardo Sanchez-Matilla

London, UK | https://risama.github.io | ricardosm89@gmail.com

PROFILE

- Research assistant carrying out independent and collaborative research with quick development of skills working on challenging problems in computer vision, machine/deep learning and multi-modal problems
- Designed vision-based algorithms for localization and shape estimation of unseen objects for accurate and safe dynamic human-robot handovers; and designed of an awarded real-time multiple object tracker from videos with object motion prediction on moving cameras up to 60% more accurate than state-of-the-art alternatives
- Demonstrated strong software experience on C/C++, Python, MatLab, ROS, PyTorch, and OpenCV; and hardware experience with motion capture systems, robotic arms (e.g. UR5 or KUKA), and multi-rotor drones (e.g. DJI)
- Management of stress and uncertainty while pursuing non-funded Ph.D., while supported through work contracts
- Main research interests: computer vision, machine/deep learning, robotics, privacy, and tracking

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RESEARCH EXPERIENCE

Computer Vision Research Assistant, Queen Mary University of London, London   **Since Oct 2014 – current**
- Coordination skills: worked in international collaborations with top-leading academic and industrial researches in projects such as COPCAMS and CORSMAL in multiple disciplines such as computer vision, deep learning and robotics
- Technical skills: Obtained strong technical skills in _C/C++_ for single and multiple object tracking with Bayesian Inference (Probability Hypothesis Density Particle Filter) [C1, C2, C3, C6]; _Python_ with _PyTorch_ and _OpenCV_ libraries for the development of traditional and deep learning models for 3D object detection and 3D shape estimation [J3, U1] (e.g. multi-view geometry and CNN); object motion prediction [C6] (e.g. LSTM), adversarial attacks and adversarial training for protecting private information from images [C4, U2]; _ROS_ for controlling robotic arms driven by computer vision algorithms [J3]; and _MatLab_ for designing and developing object detectors in highly-dense videos [J1]
- Organisation skills: developed organisation, planning and writing skills for reporting research findings trough progress reports, publications and presentations using _Latex_
- Awarded as the best performing online multiple object tracker in MOT Challenge at ECCVw [C1]

Computer Vision Intern, The Alan Turing Institute, London   **Jun 2018 – Sep 2018**
- Acquired and developed knowledge on single object tracking over occlusions using _Python_, and libraries such as _PyTorch_ and _OpenCV_ for designing novel a combination of Bayesian Inference and deep learning (i.e. convolutional Siamese Network)
- Collaborated with intern partners for problem and data analysis, solution design and implementation, and presentation the findings of the research in the form of reports and presentations to supervisors and the institution
- Demonstrated quick adaptation to new environments for solving challenging problems under time constrains

Computer Vision Researcher, Universidad Autónoma de Madrid, Madrid   **Sep 2013 – Sep 2014**
- Designed and developed object detection algorithm for high-dense videos in _C++_ and _MatLab_ using _OpenCV_ library
- Development of vision algorithms _C++_ from existing ones in _MatLab_

EDUCATION

Ph.D. in Computer Sciences, Queen Mary University of London, London   **(exp.) 2020**
- Thesis _Object localisation, dimensions estimation and tracking_
- Localising, estimating the physical properties of, and tracking objects from audio and video signals for applications such as surveillance, search and rescue, extraction of objects' patterns and robotic applications
- Protecting private information of images from unwanted inferences that use deep learning via adversarial attacks
- Autonomous research: developed skills for carrying out independent research such as data collection and analysis, problem solving, algorithm design and implementation, critical analysis, and effective verbal and written communication skills

B.Sc. and M.Sc. in Telecommunication Eng., Universidad Autónoma de Madrid, Madrid   **2014**
- Thesis _Hierarchical detection of groups of people under occlusions_
- Designed people detection algorithm in high-density settings trough a hierarchical detection method from visual data

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FURTHER WORK EXPERIENCE

Senior Teacher Assistant, Queen Mary University of London, London   **Sep 2017 – Jan 2019**
- Data Mining course for under- and post-graduate students on data analysis (e.g. _Weka_), regression, regularisation, classification (e.g. KNN, logistic regression, decision trees, Naïve Bayes), feature selection (e.g. PCA), and clustering (e.g. Kmeans)
- Data Analytics course for under- and post-graduate students on statistical foundations, financial and scientific applications of data science
- <u>Planning and leadership skills</u>: coordinated six teacher assistants for delivering laboratory course to over 200 students using _Weka_, _Python_ and _MatLab_

SELECTED PUBLICATIONS

[J3] Benchmark for human-to-robot handovers of unseen containers with unknown fillings   **2020**
- Benchmark for evaluating, and vision-robotic baseline, for human-to-robot handovers of unseen containers
- IEEE Transactions on Robotics and Automation Letters - To appear

[J2] Towards robust sensing for autonomous vehicles   **2019**
- Survey and critical analysis of the emerging field of sensing for autonomous vehicles in adversarial settings
- IEEE Transactions on Signal Processing Magazine - To appear

[U2] ColorFool: semantic adversarial colorization   **2019**
- Content-based black-box adversarial attack that generates unrestricted perturbations by exploiting image semantics
- Submitted to IEEE/CVF Conference on Computer Vision and Pattern Recognition

[U1] Multi-view shape estimation of transparent containers   **2019**
- 3D localisation and estimation of physical properties, such as shape and dimensions of unseen objects
- Submitted to IEEE International Conference on Acoustics, Speech and Signal Processing

[C6] A predictor of moving objects for first-person vision   **2019**
- Accurate model (60% more accurate than SOA) for forecasting the position of moving objects with moving cameras
- Proc. of IEEE International Conference on Image Processing

[C5] AV sensing from a quadcopter: dataset and baselines for source localization and sound enhancement   **2019**
- The first audio-visual dataset recorded outdoors from a quadcopter and baseline results
- Proc. of IEEE/RSJ International Conference on Intelligent Robots and Systems

[C4] Scene privacy protection   **2019**
- Method to protect private information of images from unwanted automatic inferences while preserving their utility
- Proc. of IEEE International Conference on Acoustics, Speech and Signal Processing

[C3] Tracking a moving sound source from a multi-rotor drone   **2018**
- Method for tracking a moving sound source from a multi-rotor drone only using audio
- Proc. of IEEE/RSJ International Conference on Intelligent Robots and Systems

[C2] Multi-modal localization and enhancement of multiple sound sources from a micro aerial vehicle   **2017**
- Multi-modal method that to enhance the speech of multiple speakers simultaneously talking from a drone
- Proc. of ACM on Multimedia Conference

[J1] Hierarchical detection of persons in groups   **2017**
- Object detector of people in highly dense settings using hierarchies of groups of people and body parts
- Signal, Image and Video Processing

[C1] Online multi-target tracking with strong and weak detections   **2016**
- Real-time online multi object tracker with Probability Hypothesis Density Particle Filter framework
- Proc. of European Conference on Computer Vision Workshop
- Awarded as the best performing online tracker in MOT Challenge at ECCVw

KEY: C: conference; J: journal; U: under peer review

VOLUNTEERING

Reviewer   **Oct 2016 – current**
- IEEE Transactions on Circuits and Systems for Video Technology
- IEEE/RSJ International Conference on Intelligent Robots and Systems
- IEEE International Conference on Acoustics, Speech and Signal Processing
- IEEE International Conference on Image Processing