Ricardo Sanchez-Matilla

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

Computer vision | Privacy | Robustness of machine/deep learning | Robotics

PROFILE

- Researcher carrying out independent and collaborative investigations on challenging problems within the fields of computer vision, machine/deep learning, and privacy
- Designed vision and audio-visual algorithms for object localization, tracking, and estimation of physical properties of unknown objects for accurate and safe dynamic human-robot interaction
- Designed privacy protection algorithms for preventing the unwanted inference of private information by deep learning
- Demonstrated strong software experience on Python, C/C++, MatLab, ROS, PyTorch, and OpenCV; and hardware experience with robotic arms (e.g. UR5), multi-rotor drones (e.g. DJI), and motion capture systems (e.g. OptiTrack)
- Management of stress and uncertainty while pursuing a non-funded Ph.D., supported through multiple research contracts

RESEARCH EXPERIENCE

Computer Vision Research Assistant, Queen Mary University of London, London **Since Oct 2014 – current**

- Coordination skills: worked in international collaborations with top academic and industrial partners in projects such as COPCAMS and CORSMAL in multiple disciplines such as computer vision, multimedia, 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]; *Python* with *PyTorch* and *OpenCV* libraries for the development of traditional and deep learning models for 3D object detection and 3D shape estimation [J3, C8] (e.g. multi-view geometry and CNN); object motion prediction [C7] (e.g. LSTM), adversarial attacks for deep learning robustness [C9] and for privacy protection of information from images [J4, C5]; *ROS* for controlling robotic arms guided by computer vision algorithms [J3]; and *MatLab* for designing and developing object detectors in highly-dense videos [J1]
- Organisation skills: developed planning, organisation 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**

- Collaboration skills: collaborated with internal colleagues and supervisors in time-constrained projects for problem and data analysis, solution design and implementation, and presentation of the research findings in the form of reports and presentations to supervisors and the institution (http://bit.ly/RSM-ATI)
- Technical skills: acquired and developed knowledge on *Python*, and libraries such as *PyTorch* and *OpenCV* for designing a novel combination of Bayesian Inference and deep learning (i.e. convolutional Siamese Network) for improving single object tracking over occlusions
- 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 algorithms for detection of objects in high-dense videos using *C++* and *MatLab* using *OpenCV* library

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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
- Data collection: design, development, acquisition, data processing, promotion of self-collected datasets for tasks such as auditory drones (http://bit.ly/RSM-AVQ) and collaboratively object recognition (http://bit.ly/RSM-CORSMAL)
- 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
- Planning and leadership skills: coordinated six teacher assistants for delivering laboratory course to over 200 students using *Weka*, *Python* and *MatLab*

SELECTED PUBLICATIONS

[J4]* Exploiting vulnerabilities of deep neural networks for privacy protection **2020**
- Method for protecting private information from unwanted inferences and robust to defences
- IEEE Transactions on Multimedia

[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

[J2]* Towards robust sensing for autonomous vehicles **2020**
- Survey and critical analysis of the emerging field of sensing for autonomous vehicles in adversarial settings
- IEEE Transactions on Signal Processing Magazine - To appear

[C9] ColorFool: semantic adversarial colorization **2020**
- Content-based black-box adversarial attack that generates unrestricted perturbations by exploiting image semantics
- Proc. of IEEE/CVF Conference on Computer Vision and Pattern Recognition

[C8] Multi-view shape estimation of transparent containers **2020**
- 3D localisation and estimation of physical properties, such as shape and dimensions of unseen objects
- Proc. of IEEE International Conference on Acoustics, Speech and Signal Processing

[C7]* 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

[C6] 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

[C5]* Scene privacy protection **2019**
- Method to the protect private information of images from unwanted automatic inferences while preserving their utility
- Proc. of IEEE International Conference on Acoustics, Speech and Signal Processing

[C4]* Confidence intervals for tracking performance scores **2018**
- Method for estimating the error in annotated datasets and to account for it within the performance measures
- Proc. of IEEE International Conference on Image 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
*: first or co-first author
Most relevant papers are underlined