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Editorial

Preface: Latest Developments, Methodologies, and Applications Based on UAV Platforms

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The use of Unmanned Aerial Vehicles (UAV) has boomed in the last decade, making these flying platforms an instrument for everyday data acquisition in many applications such as 3D modeling [1], urban planning [2], natural environment mapping [3–5], and in general, several scene inspection and monitoring applications [6]. Compared to the traditional acquisition methods, the biggest advantage of these instruments lies in their flexibility and limited costs. Flexibility refers to being easily adaptable to different operative conditions according to the user's needs: depending on the extension of the area and typology of application, very different solutions can be adopted [7]. On the other hand, affordable UAVs can fit any kind of budget availability: from cheap and consumer solutions (often called toy-drones), up to the very expensive solutions with top-end sensors on board. This clearly explains why UAVs has democratized mapping in many developing countries improving urban planning and agriculture applications [8]. In dangerous environments, the possibility to crash a UAV is then largely balanced by the risk reduction for human pilots in performing the same operation [9].

The high number of platforms available on the market, the development of new on-board units and more reliable and fast communications, as well as improved battery life have recently expanded the possibilities of using these platforms for monitoring dynamic and complex environments. Real-time processing [10] and the development of autonomous and reliable solutions [9,10], are fast leading to a next generation of UAV uses.

The implementation of innovative UAV solutions is currently triggered by an everyday larger number of users. UAVs are at the crossroad of many disciplines such as Photogrammetry, Computer Vision, Robotics, several applied Remote Sensing applications (i.e., precision farming, natural hazards, etc.), and—last but not least—Law for public safety enforcement. The interaction between these fields nowadays represents the biggest challenge for developing innovative fit-for-purpose and efficient solutions.

This Special Issue sheds some light on these recent trends, collecting papers with very different topics, representing the current developments in UAV applications. Some of these contributions were originally published in the UAV-g 2017 conference—their extended and revised version is now presented in this Special Issue.

The work presented in [11] illustrates how UAV Photogrammetry can nowadays be a solution for 3D mapping of large and complex cultural heritage area. Traditional semi-autonomous flights are adopted in this work. Optimizing data collection and time needed for the survey are the main aspects debated in the paper.

Efficiency and automation are a priority for the current use of UAVs. This is well reflected by the research described in [12], where the autonomous landing of a UAV on a moving platform is presented. This paper shows how UAVs can now reliably land on vehicles travelling fast and in windy conditions.

Exploring and mapping unknown environments is one of the main applications of drones: how to make this process autonomous and safe is still an open issue for research. In [13], an innovative methodology for selecting in real-time the next-best-view to explore an unknown environment maximizing the expected information gain of the new measurements. Additionally, this method optimizes the time and cost of the path and considers safe paths to reduce the risk of accidents.

Autonomous navigation should be performed in GNSS-denied (Global Navigation Satellite System) environments too. In these cases, visual odometry approaches can only work with continuous image sequences, while UAV localization is more problematic if the connection with previous images is lost. The work presented in [14] exploits recent developments in deep learning to regress the drone position using a small Convolutional Neural Network (CNN) using the single captured image as input.

UAV can carry different sensors on board, to be used for different applications. Reference [15] presents the use of UAV equipped with a light spectrometer conceived for land cover classification. UAV localization using photogrammetric techniques and accuracy of the hyperspectral measurements in land cover classification compared to visible and multispectral data are thoughtfully discussed in this paper.

The realized Special Issue clearly shows that UAVs are still a good field of research with many open issues. Papers we will report on how research efforts are nowadays focused on a higher automation in complex operations and challenging conditions. In the coming years, these developments will lead to a wider use of UAV platforms in many more applications.

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