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Metropolitan intelligent surveillance systems for urban areas by harnessing IoT and edge computing paradigms

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Abstract

Copyright © 2018 John Wiley & Sons, Ltd. Recent technological advances led to the rapid and uncontrolled proliferation of intelligent surveillance systems (ISSs), serving to supervise urban areas. Driven by pressing public safety and security requirements, modern cities are being transformed into tangled cyber-physical environments, consisting of numerous heterogeneous ISSs under different administrative domains with low or no capabilities for reuse and interaction. This isolated pattern renders itself unsustainable in city-wide scenarios that typically require to aggregate, manage, and process multiple video streams continuously generated by distributed ISS sources. A coordinated approach is therefore required to enable an interoperable ISS for metropolitan areas, facilitating technological sustainability to prevent network bandwidth saturation. To meet these requirements, this paper combines several approaches and technologies, namely the Internet of Things, cloud computing, edge computing and big data, into a common framework to enable a unified approach to implementing an ISS at an urban scale, thus paving the way for the metropolitan intelligent surveillance system (MISS). The proposed solution aims to push data management and processing tasks as close to data sources as possible, thus increasing performance and security levels that are usually critical to surveillance systems. To demonstrate the feasibility and the effectiveness of this approach, the paper presents a case study based on a distributed ISS scenario in a crowded urban area, implemented on clustered edge devices that are able to off-load tasks in a “horizontal” manner in the context of the developed MISS framework. As demonstrated by the initial experiments, the MISS prototype is able to obtain face recognition results 8 times faster compared with the traditional off-loading pattern, where processing tasks are pushed “vertically” to the cloud.

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Keywords

big data, cloud computing, distributed smart camera, edge computing, intelligent surveillance system, IoT, smart city, Stack4Things, stream processing

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