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The Ubiquity of Multisensor Fusion

The topic of multiple sensor fusion is becoming increasingly mainstream. For example, while cellphones have long contained cameras, magnetometers, and accelerometers, they now contain LiDAR (Light Detection and Ranging) [1] as well. A smartphone can even be strapped to one's arm to serve as a goniometer to measure the range of motion of a joint [2]. Even some smartwatches have started sporting small W-band radars for gesture recognition [3].

The cost of sensors is decreasing as their ubiquity is increasing. This means that opportunities for hobbyists abound. For example, while until a few years ago simultaneous localization and mapping (SLAM) was more within the purview of the military, Google has now started open sourcing software for LiDAR-based SLAM [4].

Given the diversity of low-cost sensors available nowadays, it is natural to want to fuse all of the available information. A prerequisite to sensor fusion is that one establish a common coordinate system across sensors. Two papers in this issue address this topic. The paper "Bias Estimation for Collocated Sensors: Model Identification and Measurement Fusion" considers measurement-level registration and fusion of collocated sensors. These could be for autonomous driving, or perhaps for some augmented reality feature in a smartphone. Additionally, the topic of multisensor fusion is taken up with the paper "Statistically Efficient Multisensor Rotational Bias Estimation for Passive Sensors Without Target State Estimation," which addresses fusion between noncollocated passive angle-only sensors.

The third paper of this issue addresses additional challenges of multisensor fusion while handling a variety of target states. Different sensors might not make measurements or produce estimates at the same rate. Additionally, some sensors might produce estimates in different coordinate systems from others. Many off-the-shelf sensors contain built-in trackers, precluding the possibility of a fully centralized tracking architecture. The paper "Heterogeneous and Asynchronous Information Matrix Fusion" addresses such issues. It considers the

asynchronous fusion of tracks from sensors in different coordinate systems.

While the fusion literature primarily focuses on the fusion of single-model estimates across sensors, the fourth paper of this issue, entitled "Track-to-Track Fusion Using Inside Information From Local IMM Estimators," discusses how to fuse estimates from sensors running interactive multiple model (IMM) estimators. Given the mature state of the multiple-model-estimation literature, it is good to see that the time has arrived for an increasing number of multiple-model-fusion algorithms.

Finally, the *ISIF Journal of Advances in Information Fusion* (JAIF) always encourages the submission of expanded papers from the International Conference on Information Fusion. This year's Fusion conference was virtual for the first time due to the COVID-19 pandemic. Hopefully, the worldwide approval and dissemination of COVID-19 vaccines (and who knows, maybe even sniffer dogs [5]) will prove effective in stemming the outbreak and will allow for the 2021 Fusion conference to be held as planned in Sun City, South Africa. I look forward to seeing many members of the fusion community there.

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