

Inertial sensors: Strength in numbers

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Inertial sensors such as accelerometers and gyroscopes are used nearly everywhere, from smartwatches to submarines, drones, spacecraft, vacuum cleaners and even game controllers. The purpose of these sensors is to indicate the position, speed or direction of an object. Their drawback is their lack of precision, at least when it comes to the low-cost versions used in many devices.

However, thanks to support from the Swiss National Science Foundation (SNSF), there may be a way to solve this problem. In a paper published in *IEEE Transactions on Signal Processing*, a team from the University of Geneva reports that networking several inexpensive sensors is a viable alternative to more powerful sensors.

Using all the information

By combining the measurements of several low-cost, individual sensors, the researchers succeeded in obtaining a very precise navigational measurement. "It is as if we had created a virtual sensor, and it is particularly efficient because it uses all the information provided by the individual sensors," says Yuming Zhang, a Ph.D. candidate in statistics and lead author of the article. These virtual sensors not only offer the same performance as actual sensors but are also less expensive and can be more flexibly configured. They could therefore be used in a number of consumer devices without increasing their cost.

The idea of combining information from different sensors is not new, but until now technical constraints have limited its application: "Sensor measurement errors are very complex to handle individually, and even more so when several sensors are combined," says Zhang. The team solved the problem using a new signal decomposition approach. This approach makes it possible to understand and deal with errors that affect measurements and to process them using a novel statistical method.

From aerial mapping to finance

According to the researchers, the potential applications of the new technique widely range from aerial mapping using drones to autonomous vehicles. In addition, the ability to optimally combine different sensor technologies could help develop a new generation of global positioning

systems.

The findings could also be used in other, more distant fields, such as finance. Investment decisions often take the form of a portfolio mix of securities and financial products designed to achieve a certain goal. "In this field as well, the method we are proposing could be used to create an optimal investment combination that minimizes portfolio volatility," says Zhang.

More information: Yuming Zhang et al, Scale-wise Variance Minimization for Optimal Virtual Signals: An Approach for Redundant Gyroscopes, *IEEE Transactions on Signal Processing* (2022). [DOI: 10.1109/TSP.2022.3208733](https://doi.org/10.1109/TSP.2022.3208733)

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