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Changes in periodic sound pulses can be analyzed to detect movement in a room.



Increasingly sophisticated security systems have been invented to detect and keep out home intruders. Common modern technologies include home security systems featuring alarms and cameras; however, these technologies can be circumvented or avoided in predictable ways. For instance, camera systems often fail to properly work in the dark, and passive microphones can only pick up audio if an intruder makes a sound.

Cheong et al. developed an active acoustic model to reliably detect intruders under any conditions.

“Our device emits a sound and records the reverberations, similar to radar,” said author Tai-Shih Chi. “It is designed to be complimentary to other types of detection methods.”

The researchers developed their system using a single speaker and microphone. To ensure its robustness, they relied on a high-resolution, high-energy ‘chirp’ sound that the speaker could reliably produce and the microphone could distinguish against background noise.

By comparing the received signal with a previously recorded test signal, the model could tell if anything in the room had changed. This method can detect stationary and silent intruders, and even those invisible to security cameras.

The team hopes their system can be used in parallel with traditional security devices to fill gaps in their coverage. They foresee this technology used in combination with ubiquitous home speakers to improve security.

“We were thinking of what functions we can add to this kind of home speaker device,” said Chi. “If they have built-in speakers and microphones, they can be used as home security devices.”

Source: “Active acoustic scene monitoring through spectro-temporal modulation filtering for intruder detection,” by Kah-Meng Cheong, Yih-Liang Shen, and Tai-Shih Chi, *Journal of the Acoustical Society of America* (2022). The article can be accessed at <https://doi.org/10.1121/10.0010070>.

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