

vibint

Member Success Case Study | Written By: Audrey Woods

VibInt

It's not unheard of for technological advances to be inspired by science fiction ideas. Star Trek famously showcased handheld flip phones and touch screens decades before such tools were possible. Video calls were being made in novels and TV shows long before they became the business staple they are today. Ear buds, autonomous cars, home robots, and many more were conceptualized by authors and screenwriters until technology caught up enough to make them a physical reality.

Inspired in part by the gesture-based interface popularized by the Iron Man film series, CSAIL postdoc Wenqiang (Winston) Chen created an AI algorithm that uses existing smartwatch technology to detect vibrations from finger and wrist gestures. As the core product of CSAIL Alliances Startup Connect member VibInt, Dr. Chen hopes his invention will help facilitate future human-computer interaction and bring about a world of ubiquitous smart devices.

VIBINT: A NEW VISION FOR COMPUTING

The idea behind VibInt began with a simple question: what will the next generation of computers look like? Dr. Chen explains that the first generation can be roughly understood as the era of personal computers, which connected people all over the world. The next generation was the era of mobile phones and handheld devices, which elevated connection to allow users to engage digitally wherever they are without needing to go back to an office or home. During his graduate studies, Dr. Chen found himself wondering what comes next? What does the next tier of connection and access look like? This led him to conclude that the next step “would be all things as computers, meaning every object, every daily thing will become a computer. It’s already happening,” he says, using smartwatches, smart glasses, and smart earphones as examples.

However, in such a “smart world,” Dr. Chen realized that we would need solutions that would help users interface with such technology. “We cannot use a keyboard or touch screen for the next generation of computers because you will need to control it remotely,” he explains, saying that he imagines “people will control everything using hand gestures.” This led him to the idea of creating an AI algorithm to recognize vibrations in the air caused by hand gestures, using the existing gyroscopes and accelerometers in current smart watches—which right now count steps and measure speed—as sensors. He says, “the hardware is already there” and they just needed the right algorithms to retrofit it for this new purpose.

Of course, such a process was easier said than done. Dr. Chen explains that, in the course of developing an algorithm that could take current smart watches and allow them to sense hand gestures, he and his colleagues ran into some key technological challenges stemming from the problem of noise. He says, “when you are moving, even when you’re talking, they’re all vibrations, so it’s very noisy. So how can we detect finger vibrations from those noisy movements, walking, talking, even heartbeats?”

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VIBINT: A NEW VISION FOR COMPUTING (*cont.*)

The first hurdle to overcome was putting together the right training data. To create a model that could differentiate between gestures and filter out the background noise, the researchers needed “hundreds of people in hundreds of hours of data,” a resource that just wasn’t available at the time. So Dr. Chen and his fellow researchers set out to collect this necessary on-body sensor data and offer a better way to gather it in the future, the results of which they [published in 2021](#).

After that, around the time Dr. Chen was starting the company, he realized that, despite their extensive training efforts, the program’s accuracy wasn’t what it needed to be. The problem, he explains, is that gestures are continuous, making it challenging to label a signal as one thing or another. Quite unlike training an AI model to label a picture as a dog or a cat, training their model to recognize gestures as discrete signals while a user is continuously moving proved difficult. This led to the development and [publication](#) of a new technique which was able to recognize continuous finger writing and achieve 90% or more accuracy with numbers and letters.

Most recently, Dr. Chen and his colleagues released [ViWatch](#), which combines their previous work to enable a robust hand-typing system and relies on a single sensor that is ubiquitous in most smartwatches. Users of ViWatch were able to achieve about a 97% accuracy over a week in various deployment variations, such as different hand shapes, finger activity strengths, and smartwatch positions on the wrist. This and other research has come together to help Dr. Chen create the model VibInt now offers as an API, which can take existing smartwatch technology and allow it to recognize skin typing, air writing, wrist gestures, and more.

CSAIL ALLIANCES: CONNECTING WITH POTENTIAL CUSTOMERS & EVENTS

During the process of forming VibInt—which is now 3 years old—Dr. Chen has found CSAIL Alliances “very helpful for improving our company’s visibility.” For example, Dr. Chen was glad to have been introduced to a venture building arm of oil company PTT Exploration and Production called [AI and Robotics Ventures](#) (ARV), a CSAIL Alliances Affiliate. Dr. Chen says that after being connected through Alliances, his team brought a prototype to ARV in Thailand, which the company was “very interested in.” This has led to an ongoing conversation Dr. Chen hopes will create a lasting partnership.

“Thanks to Alliances, we get connected [to companies] and we start to find out together how to cooperate with each other, and that’s really helpful,” Dr. Chen says, especially for a small company without the resources to cold-call hundreds of potential clients a day.

Dr. Chen has also taken advantage of CSAIL Alliances events such as the 2023 Annual Meeting, where he presented a [video poster](#) of VibInt’s algorithm at work. He says that during the poster session “a lot of people came to me to ask questions and got really excited about this gesture thing and writing in the air just using vibrations.”

For this level of exposure, Dr. Chen is grateful and plans to continue utilizing his link to CSAIL through the CSAIL Alliances program to connect with potential customers and partners.

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LOOKING FORWARD

Fueled by an enthusiasm for futurist thinking, Dr. Chen imagines that his vision of a smart world will come in three stages. “The first stage, in two or three years, will be focusing on the wearable device, like smartwatches and smart glasses, using these gestures and finger vibrations to control existing smart devices.” Then, in five or more years, he imagines the Metaverse or similar technology “taking off,” creating a more urgent need for users to “use gesture control to manipulate things.” Finally, Dr. Chen says, “in five to ten years, everything will be a computer. That means not just my device [but] shoes, clothes, even walls—everything you interact with in your daily life will all become computers.” At that point, he believes technology like VibInt’s will become as universal as cellphones are today.

Ultimately, Dr. Chen hopes that such a technological shift could be a force for good. He describes his dream of a world powered by robots and computers, where people no longer need to make food, clothes, etc. If everything becomes smart, it could leave human beings with the freedom to pursue their talents and joys. He elaborates, “we will need an entire world to help people, so you don’t need to work on the things you don’t like. That means it needs to be an intelligent world. Eventually, everything will become smart.”

When asked what motivates him, Dr. Chen says, “I really want to see my research impact the real world. That’s the thing that gets me excited.” By leveraging the resources offered by CSAIL Alliances to engage with companies and continue expanding on what their algorithm can do, VibInt is aiming to do just that.



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