

I KNOW HOW YOU FEEL

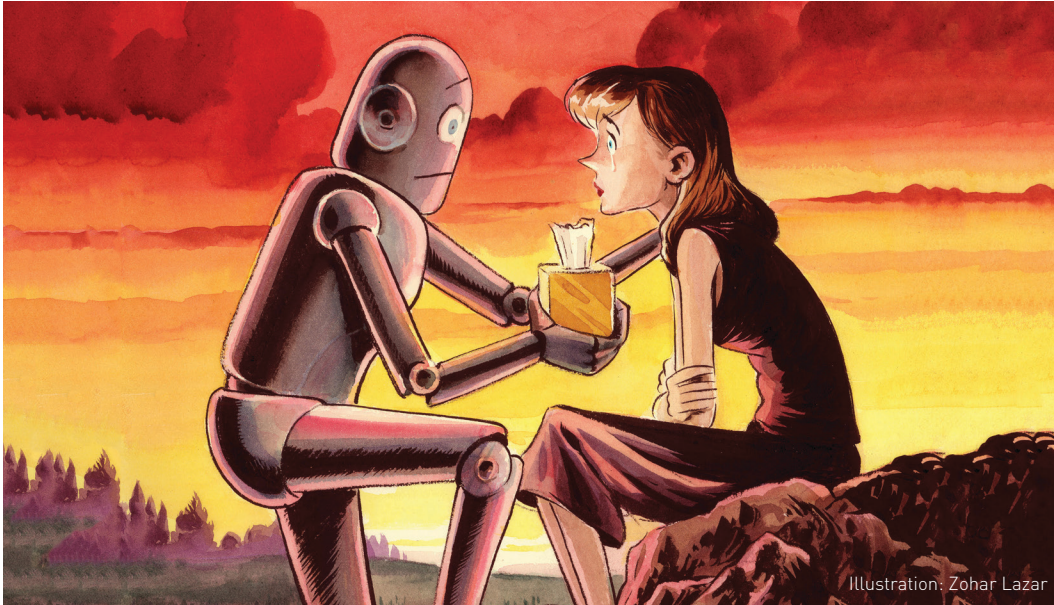


Illustration: Zohar Lazar

“The concept of empathetic robots can go far. In the next few years you are going to see an explosion of ideas”

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PROF PASCALE FUNG
Professor of Electronic
and Computer Engineering

It is perhaps no coincidence that it has taken a woman engineer to build the virtual mind of a robot that goes further than any other in the empathy it – or rather she – can display.

Meet Zara the Supergirl, the virtual agent with emotional intelligence created at HKUST by one of the leading researchers in the field, Prof Pascale Fung, and her diverse student team.

Unlike most of the current speech recognition systems, Zara has been programmed to detect meaning and intent during conversations and respond to the emotion and personality type of her user by observing their facial expression, manner of speaking, language used, and the context. This breakthrough has attracted global academic, industry and popular media attention since Zara was first unveiled at the 2015 World Economic Forum in Davos. While some form of emotional intelligence in avatars is not new, Zara represents the first full integration of multimodal emotional perception and response in an artificial intelligence (AI) system.

The frontier development is a result of advanced tools and algorithms devised by Prof Fung, whose goal is to create virtual agents and robots that can be viewed as buddies rather than unfeeling machines. What makes Zara’s extraordinary “mind” tick? “We came up with an empathy module for recognizing emotion from the way people talk, based on large

amounts of audio data from different nationalities and cultures,” Prof Fung said. This required teaching machines not only to recognize the meaning of words but also comprehend acoustic signals and facial expressions – just as a human would. “And by learning, Zara can figure out what to do next. She uses recognition of emotion and personality to enable the system to converse and feel what the user feels.”

Such advanced functionality builds on the University’s expertise in multilingual spoken language understanding developed over the past two decades. Zara’s “talents” are achieved through neural network machine learning.



Zara the Supergirl



Prof Pascale Fung

Zara the Supergirl in conversation with her creator. Zara is multilingual and can comprehend emotions from how a person looks and sounds.

The learned output is derived from “neurons” firing signals across multiple layers while simultaneously adjusting weighting functions and biases across these layers. Algorithms developed by the HKUST team enable them to make Zara and related applications increasingly responsive in real time.

The personality recognition capacity that Prof Fung’s team has developed draws on common classifications used by psychologists, including the Big Five personality traits and Myers-Briggs indicators. Personality of the user is assessed in a question-and-answer session that takes less than five minutes. Zara’s responses mimic how we intuitively react with different audiences, whether a child or adult, man or woman.

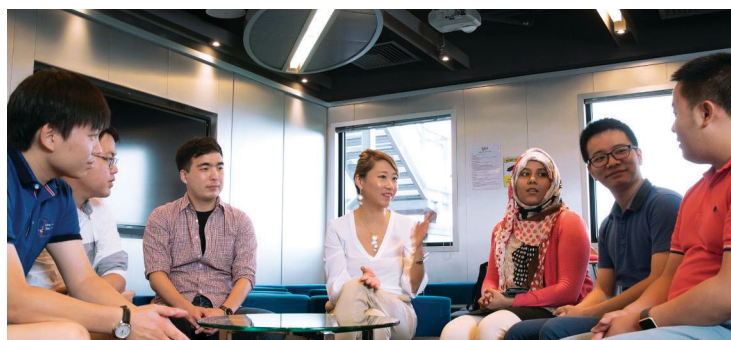
Since Davos, the team has refined multiple facets of linguistic and emotional intelligence for robots and avatars. As Zara interacts with more people and gathers more data, the machine-learning algorithms enable her to be more intelligent and more empathetic. The technology behind Zara will take the leap from screen to embodiment in the form of a receptionist robot, who will interact with visitors to HKUST, and guide them to their destinations.

The potential applications of empathetic machines are endless. Prof Fung is particularly excited about uses in healthcare, which range from monitoring when an elderly person needs help to assisting in the diagnosis of Alzheimer’s disease. Prof Fung’s team has also developed a virtual psychologist using similar technology to Zara, focusing on detecting stress and depression in a user, and providing counseling services. In human resources, it can be used for initial job interviews without the unconscious bias inherent in human interviewers. For business and finance, the team is extending speech and language data analytics to sentiment analysis.

The technology is already available commercially in a smart “robot speaker with a heart” that

senses your mood by interacting with you, and responds with the music and lighting to match. Music is suggested according to the time, weather, and the user’s previous listening choices. The classification of music is again based on a neural network algorithm that recognizes the mood, genre and even artist for each piece.

Prof Fung, a founding member of the Human Language Technology Center at HKUST, established in 1997, leads an international team of postdoctoral researchers and students from Asia and Europe. This is helpful for the research as students coming from different cultural and educational backgrounds bring different insights and perspectives to the



Prof Fung and her team of students from diverse backgrounds work to enhance the emotional intelligence of their virtual agents.

interdisciplinary field of AI. The team is enhancing AI capacities in areas such as conversational humor, abusive language recognition, mood recognition, music retrieval, and sentiment analysis. One of her students is working on the algorithms that will make the voice of virtual agents such as Zara more emotional.

While Prof Fung is fascinated with humanistic robots, she is alert to the potential societal challenges that AI poses. She is a member of the Global Future Council on AI and Robotics of the World Economic Forum, which advises policymakers and CEOs to be mindful about the usages of technology, and believes laws and regulations will be needed to prevent abuse.

Empathetic Robots, Wide-reaching Applications

