Scientists turn to AI to make beer taste even better

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Whether you prefer a fruity lambic or a complex Trappist, Belgian beers have long been famed for their variety, quality and heritage. Now, researchers say they have harnessed the power of artificial intelligence to make brews even better. Prof Kevin Verstrepen, of KU Leuven university, who led the research, said AI could help tease apart the complex relationships involved in human aroma perception. “Beer – like most food products – contains hundreds of different aroma molecules that get picked up by our tongue and nose, and our brain then integrates these into one picture. However, the compounds interact with each other, so how we perceive one depends also on the concentrations of the others,” he said. Writing in the journal Nature Communications, Verstrepen and his colleagues report how they analysed the chemical makeup of 250 commercial Belgian beers of 22 different styles including lagers, fruit beers, blonds, West Flanders ales, and non-alcoholic beers. Among the properties studied were alcohol content, pH, sugar concentration, and the presence and concentration of more than 200 different compounds involved in flavour – such as esters that are produced by yeasts and terpenoids from hops, both of which are involved in creating fruity notes. A tasting panel of 16 participants sampled and scored each of the 250 beers for 50 different attributes, such as hop flavours, sweetness, and acidity – a process that took three years. The researchers also collected 180,000 reviews of different beers from the online consumer review platform RateBeer, finding that while appreciation of the brews was biased by features such as price meaning they differed from the tasting panel’s ratings, the ratings and comments relating to other features – such as bitterness, sweetness, alcohol and malt aroma – these correlated well with those from the tasting panel. “Tiny changes in the concentrations of chemicals can have a big impact, especially when multiple components start changing,” said Verstrepen, adding that one surprise was that some substances traditionally known to be a turn-off could be positive if present in lower concentrations, and occur in combination with other aroma compounds. Using the different sets of data, the team constructed models based on machine learning – a form of AI – to predict how a beer would taste, and its appreciation, based on its composition. They then used the results to enhance an existing commercial beer, essentially spiking it with substances flagged by the models as being important predictors of overall appreciation – such as lactic acid and glycerol. The results from the tasting panel revealed the additions improved ratings for both alcoholic and non-alcoholic beers across metrics including sweetness, body, and overall appreciation. While the models have limitations, including that they were only developed using datasets based on high-quality, commercial beers, Verstrepen said their biggest application could be in tweaking non-alcoholic beers to make them better. But beer lovers need not worry that new technology could disrupt a rich heritage, with Verstrepen noting the skill of brewers remains vital. “The AI models predict the chemical changes that could optimise a beer, but it is still up to brewers to make that happen starting from the recipe and brewing methods,” he said.