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Collective Intelligence Improves Mammography Screening

A new study by an international team of scientists shows that swarm intelligence can be used to improve the efficiency of mammography screening for breast cancer. The study, published in *PLOS ONE*, was led by Dr. Max Wolf, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) in Berlin, Germany.

Wide-ranging mammography screening programmes have been set up for early diagnosis of breast cancer in women. However, even if two physicians assess the x-rays, which is the usual procedure in Europe, this often leads to wrong decisions: about 20 percent of patients with cancer are diagnosed as being cancer-free, whereas about 20 percent of cancer-free patients are diagnosed with cancer.

“A screen is usually examined by two physicians. The goal of our study was to investigate whether the independent assessments of several physicians, let us say 3, 5 or even 10, would lead to significantly better results,” said Dr. Wolf. For this study, Dr. Wolf and colleagues used one of the largest international mammography datasets. This dataset includes a large number of mammograms and for each of them the independent assessment of about one hundred radiologists as well as the actual health status (cancer yes or no) of all patients.

Using simple collective intelligence rules like majority vote or quorum vote, the researchers showed that already five independent assessments from the dataset can be used to outperform the diagnostic accuracy of even the best physician within that group. The researchers also found that, compared to the best physician, the collective intelligence approach was effective in reducing both the number of false positives (cancer diagnosis/though no cancer) and the number of the false negatives (no cancer diagnosis/though cancer).

This collective intelligence effect, according to the research team, already occurs when a relatively small number of independent assessments of three or four physicians is used. “Our results show that a higher number of independent assessments leads to better results," Dr. Wolf noted. "However, the benefit of additional assessments significantly starts to level off at about 8 or 10 assessments.”

The research team says the collective intelligence approach could easily be automated and integrated into the mammography screening programme: The evaluators would independently assess the digital x-rays on the computer and give their vote. Afterwards, a final diagnosis would be made based on these assessments and the employed collective intelligence rule like majority vote.

“When it comes to improving diagnostic accuracy, the first impulse is often to improve technology. We believe, however, that a collective intelligence approach has the potential to improve diagnostic accuracy in a wide range of medical decision-making contexts,” Dr. Wolf pointed out.

Source and image credit: Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB)

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