

Collective intelligence helps to improve breast cancer diagnosis

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For their latest study, the scientists used one of the largest international mammography datasets. Credit: Rainer Sturm / pixelio.de

Breast cancer is the most frequent type of cancer in women and currently accounts for 29% of all new cancer cases in the U.S. Wide-ranging mammography screening programs have been set up for early diagnosis. However, even if two physicians assess the x-rays, which is the usual procedure in Europe, this often leads to wrong decisions: about 20% of patients with cancer are diagnosed as being cancer-free, whereas about 20% of cancer-free patients are diagnosed with cancer. A new study shows that swarm intelligence can help to considerably improve cancer diagnosis.

An international and interdisciplinary research team led by Dr. Max Wolf, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) in Berlin, wanted to find out whether collective intelligence can be employed to improve [breast cancer](#) screening. "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 three, five or even ten, would lead to significantly better results," says Max Wolf. In order to investigate this issue, the scientists used one of the largest international mammography datasets. This data set 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.

Five independent assessments lead to better results

On the basis of this dataset, the scientists showed that already five independent assessments can be used to outperform the [diagnostic accuracy](#) of even the best physician within that group. In order to do so, the physicians' assessments have to be integrated using simple collective intelligence rules like majority vote or quorum vote. Importantly, compared to the best physician, such a collective intelligence approach

allows to lower 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 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; however, the benefit of additional assessments significantly start to level off at about 8 or 10 assessments," remarks Max Wolf.

The team of scientists has come to the conclusion that the efficiency of mammography screening can be enhanced by the principle of collective intelligence. The procedure is very simple and could easily be automated and integrated into the screening program: 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," concludes Max Wolf.

More information: "Collective intelligence meets medical decision-making: the collective outperforms the best radiologist," *PLOS ONE*. [dx.plos.org/10.1371/journal.pone.0134269](https://doi.org/10.1371/journal.pone.0134269)

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