

New computational model can predict breast cancer survival

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Columbia Engineering researchers, led by Dimitris Anastassiou, Charles Batchelor Professor in Electrical Engineering and member of the Columbia Initiative in Systems Biology, have developed a new computational model that is highly predictive of breast cancer survival. The team, who won the Sage Bionetworks / DREAM Breast Cancer Prognosis Challenge for this work, published their results—"Development of a Prognostic Model for Breast Cancer Survival in an Open Challenge Environment"—in the April 17 issue of *Science Translational Medicine*.

In earlier work, Anastassiou and his team had identified what he calls "attractor metagenes," gene signatures that are present in nearly identical form in many [cancer types](#). Working with his PhD students Wei-Yi Cheng and Tai-Hsien Ou Yang, he took these signatures and tested them in the Sage Bionetworks/DREAM [Breast Cancer Prognosis](#) Challenge, a crowd-sourced effort for accurate breast cancer prognosis using molecular and clinical data. The team developed a prognostic model that showed that these signatures of cancer, when properly combined, were strong predictors for breast [cancer survival](#).

"These signatures manifest themselves in specific genes that are turned on together in the tissues of some patients in many different cancer types," explains Anastassiou. "And if these general cancer signatures are useful in [breast cancer](#), as we proved in this Challenge, then why not in other [types of cancer](#) as well? I think that the most significant—and exciting—implication of our work is the hope that these signatures can

be used for improved diagnostic, prognostic, and eventually, therapeutic products, applicable to multiple cancers."

Currently there are already widely used biomarker products that look at specific genes in biopsies of [cancer patients](#), so that doctors can decide if particular treatments are appropriate. "Some of these genes are related to those in our signatures," he says, "so it's worth finding out if replacing such [genes](#) with our precise 'pan-cancer' signatures will improve the accuracy of these products."

Anastassiou, who works in [systems biology](#), an emergent interdisciplinary field that focuses on interactions within biological systems, hopes to collaborate with medical researchers studying the biological mechanisms behind these cancer signatures. He thinks of these signatures as "bioinformatic hallmarks of cancer," a term first coined by Jessica Kandel, R. Peter Altman Professor of Surgery and Pediatrics in Columbia's Institute for Cancer Genetics, with whom he collaborates.

"The hallmarks of cancer," he explains, "are unifying biological capabilities present in all cancers, as described in some seminal papers. We think that we have now reached the point where systems biology can also identify such hallmarks."

"We are thrilled that Anastassiou's innovative metagenes approach won the Challenge and is getting the visibility it rightly deserves," says Stephen H. Friend, president and co-founder, Sage Bionetworks.

"Anastassiou's team demonstrated gumption and a thoughtful understanding of what was needed to develop a 'generalizable' model that achieved the top CCI score against the newly generated Challenge validation data set."

Anastassiou and his team found the Sage Bionetworks/DREAM

Challenge a very productive way to focus on a specific research task. He said that the Challenge provided a vibrant research environment where numerous participants were openly submitting their models and had access to others' models as they were developed. The teams were also encouraged to incorporate the other models into their own. Three hundred fifty-four participants from more than 35 countries registered for the Challenge and submitted more than 1700 models.

The study was funded by the University's allocation for inventor's research—patents from what Anastassiou calls his "previous lifetime," when he was doing research on a totally different topic: digital television. His patents are now used in the international standards for all forms of DVDs including Blu-ray HDTV discs and digital television broadcasting.

Provided by Columbia University

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