factor for pancreatic cancer. It would therefore be worth determining whether bacteria are present in the pancreas during pancreatitis and, if so, whether these bacteria contribute to cancer development and possible escape from the effects of subsequent cancer drug treatment.

Changes in response to cancer treatment can be driven by several factors, including the genetic background of the tumour cells, or bacterial-induced changes to tumour-cell signalling. Geller and colleagues' work adds microbial metabolism of anticancer drugs as another potential contributor to poor prognosis when tumours are treated. Although more data will be needed to firmly establish whether microbial metabolism within tumours normally affects the success of tumour treatment, the findings reveal a potential new therapeutic strategy for anticancer treatment. ■

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COMPUTER SCIENCE

Data analysis meets quantum physics

A technique that combines machine learning and quantum computing has been used to identify the particles known as Higgs bosons. The method could find applications in many areas of science. **See Letter p.375**

STEVEN SCHRAMM

With the advent of high-performance computing and the ability to process enormous amounts of data, the need for advanced data-analysis techniques continues to grow. This is particularly true for experiments at the Large Hadron Collider near Geneva, Switzerland, where particle collisions occur up to 40 million times per second[1], generating enormous data sets. These data sets often involve only a tiny number of the particles of interest — for instance, the particles called Higgs bosons are produced approximately once every billion collisions[2,3]. On page 375, Mott *et al.*[4] report a data-analysis technique that unites machine learning and quantum computing, and apply it to the problem of identifying Higgs bosons. Their approach has advantages with respect to conventional methods[5,6] and opens up further opportunities for research.

Rare events at the Large Hadron Collider, such as the production of a Higgs boson, are identified using classifiers — combinations of variables whose values depend on the particles produced in the collisions. Classifiers need to be optimized to maximize the sensitivity of the data analysis to rare events and to reject the typically abundant background events that result from ordinary particle-physics processes. Such optimization has conventionally been achieved either by testing combinations of variables manually or by using machine-learning techniques. Each of these approaches has advantages in different situations and both were instrumental in the discovery of the Higgs boson[7,8] in 2012.

Human-constructed classifiers often have a physically intuitive meaning and can be optimized using a relatively small amount of data. However, the optimization procedure can require a substantial investment of human time. Furthermore, it rarely fully exploits correlations between variables, meaning that the data analysis is not as sensitive to the signal of interest as it could be.

By contrast, machine-learning techniques mostly need computing time rather than human time to find optimal variable combinations. In addition, they exploit both linear and non-linear correlations between variables, therefore maximizing the sensitivity of the data analysis. However, these methods require a substantial amount of data, and the optimal classifier usually does not have a clear physical meaning.

Mott and colleagues report an alternative

50 Years Ago

Our society is crimogenic, in that our social structure produces most crime, which must therefore be regarded as one "normal" response to social stimuli. For an adequate understanding of its causation, and of appropriate remedial action, we must therefore rely primarily on sociology, with the assistance of psychology … The author makes it clear that most crime is confined to the younger age groups, is predominantly against property and not too serious, and is amenable to containment and reduction by effective community action. His prescription mainly emphasizes the desirability of a restructuring and fuller integration of the educational service in the widest sense, embracing the schools, youth service and the corrective institutions for the young.
From *Nature* 21 October 1967

100 Years Ago

I have never seen the following phenomenon described; perhaps a physiologist can give the explanation. If the eye is fixed on a stream of water for twenty or thirty seconds, and is then turned on to a fixed object, the part of the field of view that had previously been occupied by the stream appears to move in a contrary direction to that in which the water had been moving; the apparent motion slows down rapidly and ceases in from five to ten seconds. This is seen not only with lateral motion, but also with up-and-down motion, as when a stream is looked down on from a bridge. The phenomenon is perhaps best seen with running water, but it may be observed with other bodies in motion—a passing train, for instance. The effect is very curious, as only part of the field of view appears to move.
From *Nature* 18 October 1917