OUT OF HOURS Christopher Martyn

Diagnosis by machine

Computerised diagnostic tools have not yet supplanted doctors, for a very good reason

Two or three decades ago there was much excitement about how computers were going to make diagnosis faster, more accurate, and more reliable. In the United Kingdom, and doubtless many other countries too, some accident and emergency departments had an early generation personal computer running Bayesian algorithms for the diagnosis of acute abdominal disorders. If you typed in answers to the questions it posed you got a differential diagnosis and the associated probabilities for your particular case. Several studies were published showing that such algorithms increased diagnostic accuracy and reduced the numbers of negative laparotomies.

Artificial neural networks were more sophisticated than the Bayesian stuff. The buzz words were parallel distributed processing and connectionism, and part of the allure of this approach was the link with cognition and neuroscience. It was hoped that these networks would be capable of extracting patterns from the noisy, messy, and incomplete sort of information you end up with after taking a history from a patient. There was also enthusiasm about expert systems—software intended to reproduce the decision making process of experienced clinicians, which would allow less experienced clinicians to achieve similar rates of diagnostic accuracy.

So what went wrong? Why aren't any of these things part of the furniture today? Their absence is all the more surprising given that computing power has increased so much. Was it that they didn't work as well as their inventors hoped? Or did clinicians resist the idea of leaving life or death decisions to black boxes whose functioning they didn't understand? Or, another possibility, was the accuracy of diagnosis already at such a high level that computers were more or less redundant?

The first of these reasons is almost certainly correct. Computer diagnosis didn't work well except in situations where the range of possibilities was very small. The difficulty of writing programs that would enable computers to match the performance of expert clinicians, let alone improve on it, had been hopelessly underestimated. Something similar turned out to be true for many other potential applications of artificial intelligence. Despite high hopes and huge investment, computational solutions failed to live up to their promise in language translation, pattern recognition, problem solving, and logical reasoning.

This means that the second possibility, that these diagnostic computers aren't around because clinicians failed to accept the new technology, doesn't really arise. It was hardly likely in any case. You only have to consider the alacrity with which doctors have taken up each advance in diagnostic imaging to realise that the profession has no prejudice against technological innovation.

The third idea, that clinicians were already so good at diagnosis that they didn't actually need computers to help them out, seems absurd at first sight. But perhaps there is a grain of truth in it. Everyday experience suggests that doctors are pretty good at diagnosis—at least in patients who are actually ill. Not many serious diseases go undiagnosed for long. On the whole, doctors care a lot about getting diagnoses correct, and they castigate themselves when they fail. They gain kudos for being right and feel shame when they are wrong. Rather admirably, when they do make diagnostic errors, they talk about them. Most issues of the *BMJ* have a filler or a lesson of the week describing such mistakes and how they occurred and might be prevented from recurring.

What's more, the structure of medical care contributes to diagnostic accuracy. The diagnoses of junior doctors are routinely scrutinised by their more experienced senior colleagues. Diagnostic puzzles can be sent on to specialists without any loss of face on the part of the referring doctor. Difficult cases get discussed formally at clinical meetings and informally among peers.

> **Studies of diagnostic delay and error have hardly got beyond the stages of anecdote and case series**

But it's rather a pity that attempts to find computational methods to diagnose illness have fizzled out. They provided a powerful stimulus for understanding how doctors go about the task. Although it's cheering that we're not about to be replaced by machines, the process of diagnosis is understudied and worth further investigation. It is, after all, central to a lot of medical practice. A correct diagnosis provides a keyword that unlocks the collective experience and literature about treatment and prognosis. We don't know all that much about how doctors reach their diagnostic decisions or what makes some people better at it than others. And studies of diagnostic delay and error have hardly got beyond the stages of anecdote and case series.

The most recent incarnation of computer aided diagnosis involves the internet. A couple of months ago a case report in the *New England Journal of Medicine* described a 72 year old man from the Philippines with diarrhoea, weight loss, abdominal pain, and intermittent fever. Eventually a correct diagnosis of the rare condition of intestinal capillariasis was made. The doctors involved later discovered that an internet search that used the keywords "Philippines," "endemic," "parasite," and "chronic diarrhea" would have come up with case reports of the same disease as the first two hits. This is intriguing but a long way from showing that internet search engines are a useful diagnostic tool. As Mark Twain might have said: "Be careful about visiting health related websites; your patient might die of a misprint."

Christopher Martyn is associate editor, *BMJ* cmartyn@bmj.com

MEDICINE AND THE MEDIA

Picture imperfect

What happened when a sharp eyed orthopaedic specialist used his medical knowledge to uncover the true story behind a photo on the front page of *The Sunday Times?*

I am not your average newspaper addict, but once in a while, depending on the day of the week and the flavour of the month, I do pick up a broadsheet newspaper from my local grocer's or from the coffee shop. On Sunday 29 June, with the unattractive prospect of being stuck in the hospital for another 24 hours, I decided to indulge myself in a cup of coffee from the cafe next door along with a copy of *The Sunday Times.* A cursory glance at the front page showed that Mugabe's regime was wreaking yet more havoc in Zimbabwe. Accompanying the story was a picture of a child in plaster casts. I was keen to get to the sports pages and the Wimbledon news, but suddenly it struck me that there was something odd about the photograph. A closer look made me realise that the photograph was out of sync with the rest of the report.

The 11 month old boy had plaster casts on both legs below the knee, allegedly after trauma inflicted by Mugabe's tyrants. That couldn't be true. Firstly, the legs and feet were deformed and turned in. Even in Zimbabwe plaster casts after trauma would be applied so that the legs and feet looked as anatomically correct as possible. No one would put plasters on with the feet still deformed, unless of course the deformity had not been secondary to trauma. Secondly, the plaster casts on both feet looked identical, with the same deformities. If the report were to be believed then it had to be an identical set of injuries—extremely unlikely. Thirdly, the mechanism was all wrong. A child doesn't get his or her legs and feet crushed by being hurled to the floor. The plaster casts seemed to be corrective casts for clubfeet, the commonest type of limb deformity present at birth. My diagnosis was congenital talipes equinovarus.

Promptly I emailed the editorial desk and the foreign affairs section at *The Sunday Times,* expressing my concerns. About 36 hours later I got a reply from the pictures editor saying that they were waiting for the photographer's arrival at a safe place so that they could ascertain the circumstances in which the photograph had been taken. What about clarifying the matter with the reporters on the story, who must have had access to the child and mother in question? It seemed to be a first hand report. Apparently the reporters responsible were freelance, not employed by *The Sunday Times,* and there could have been errors in translation.

A few more emails went to and fro. I was getting frustrated by the delay in clarifying matters. Then a further piece was published on 6 July, which at first glance looked like an unreserved apology (www.timesonline.co.uk/tol/news/world/africa/article4276338.ece). Closer scrutiny showed that this was not so. This piece said that concerns were first raised when one of the reporters took the child for treatment at the local hospital in Harare. So apparently the false nature of the claim was detected only when the newspaper pursued the story on altruistic, humanitarian grounds, not when the error was pointed out to them. This was a bit strange, given that my first email questioning the veracity of the report and photograph had been sent by 2 30 pm on 29 July, with two follow-up emails the same evening—all in all three emails within 24 hours of the paper hitting the stands. This seemed like an attempt by the newspaper to mask its

The 11 month old boy had plaster casts on both legs below the knee, allegedly after trauma inflicted by Mugabe's tyrants. That couldn't be true

error while claiming the moral high ground. Also, I realised that the same story and the photograph had been published first in *The New York Times* and then later in *Newsweek.* The *Newsweek* article on 3 July showed the child without the casts, giving clear evidence of bilateral clubfeet (www.newsweek.com/id/144521). And yet the accompanying article discussed the severity of the inflicted trauma, which caused the child's feet and legs to be turned in. The small matter of the photograph showing uncasted, deformed feet had obviously escaped the editors' notice. On 9 July *The New York Times* issued an editor's note confirming the false nature of the report and the photograph (www.nytimes.com/2008/06/26/world/africa/26zimbabwe.html).

Was it my email that led to the newspapers coming out with the truth? I honestly don't know. An attempt to clarify the precise sequence of events with *The Sunday Times* was met with stony silence. I do wonder, however, what happened to the boy whose clubfeet needed orthopaedic treatment. Did the newspapers follow up their interest in his wellbeing after it was discovered that his deformities were not inflicted by Mugabe's regime?

Manoj Padman, national paediatric orthopaedic fellow, Sheffield Children' Hospital mnjpd@aol.com