Water treatment

Blackwell
Water Consultancy Ltd

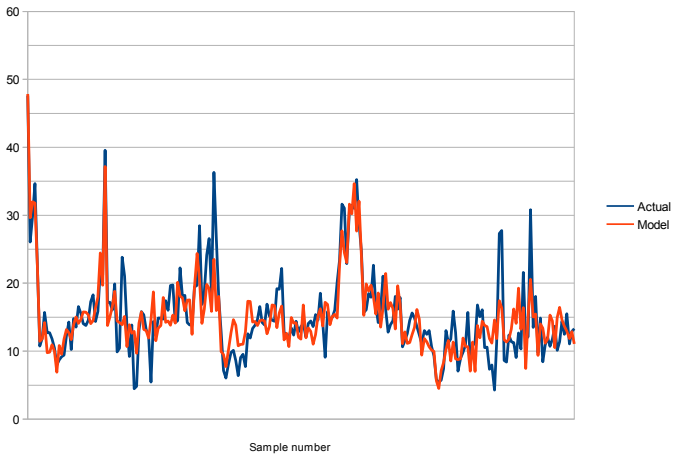
Forecasting water filtration plant performance

Many times over the last twenty years have I heard debates and arguments about the best technique for modelling water and wastewater treatment processes. There will always be those who favour the conventional mechanistic models based on chemistry, physics, maths and biology. There'll always be a camp that prefers empirical models such as regressions based on process data. Blackwell Water Consultancy Ltd doesn't have a favourite modelling technique: we simply use which ever method gives the best model. Defining “best” is a subject for a completely different article!

Our client in this case operates a water treatment works that supplies part of a major city. The plant operates satisfactorily and the site staff do a good job. However, the asset owners wanted to make sure the works could cope with future water demand. To do that, they had to understand how the asset performs now. Enter Blackwell Water Consultancy Ltd.

The client gave us a data set covering several years of operation at the site. We analysed it and immediately saw that some of the treatment units in the works operated much more effectively than others. Why? Looking at the data more closely we suspected the flow to the various filters was not split evenly and this had an effect on the chemical dosing and mixing as well. Our client confirmed that an independent study had drawn the same conclusion. What they really wanted to do, however, was to be able to forecast the performance of the plant based on the composition of the untreated raw water entering it. We looked at traditional mechanistic models of water treatment processes. They simply couldn't cut the mustard. The estimates of filter run time and headloss were poor and it was clear such models a) needed a very intensive data collection survey to improve them but b) he survey probably wouldn't improve he models as much as was needed. Consequently we turned out attention to empirical models.

We tried various forms of regression, neural networks and symbolic regression (otherwise known as genetic programming). The first and third methods gave excellent insight into which raw water parameters were exerting the greatest influence on works performance. However, neither method produced really robust and accurate models. Enter our old friend, the neural network. These produced highly accurate and robust models that performed extremely well when faced with new data. The client was very happy with the new-found ability to model filtration at the site and they've asked us to extend the approach to four other sites.



There are a number of benefits to this:

1. the statistical analysis helped us to come up with an optimisation plan for the works
2. the client now sees the value of analysing in detail historical data
3. the models, implemented as simple spreadsheets, are already improving future capacity plans

And there you have it. A huge amount of value was extracted from existing data, giving the client a much greater understanding of their asset and how to plan its future.

Blackwell Water Consultancy Ltd provide consultancy about all aspects of sewage treatment, industrial effluent treatment and water efficiency.

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