THE TIMES
HIGHER
EDUCATION SUPPLEMENT

Computer brain gets colour mix

THES reporters review the best of the papers from the Institute of Physics annual congress in Leeds PAINT manufacturers are hoping a computer model of how the brain perceives colour could help them tailor their palettes to meet customer demand better.

Keele University scientists are working on a method of colour creation using neural networks, a computing system that artificially mimics the way nerve cells operate in the brain.

Researchers at the human and machine perception research centre say that the use of neural networks will enable a far better representation of how humans perceive colour than is possible using conventional physics.

Stephen Westland presented the latest results of the work this week at the Institute of Physics annual congress, held at Leeds University. He explained that manufacturer's often have to meet a target colour set by a product customer. One of the big problems is how to compare the colours on two surfaces to decide whether they are the same.

Firms have to be able to predict the dyes and pigments (called colourants) required to create the target colour, but also know the precise proportions in which they should be mixed.

Dr Westland said that conventional methods of measuring, comparing and making colours are based on the classical physics of colour. One technique is to analyse the distribution of its energy in that part of the spectrum visible to humans. In theory, the spectra of one colour can then be compared against another.

But a simple comparison would be unlikely to yield useful predictions of colour difference because the human eye is more sensitive to pigment variations at certain wavelengths than it is at others.

Dr Westland added: "Work on different methods of predicting colour difference has generated around a hundred equations derived from psychophysical data, but none have been totally satisfactory. What we are trying to do is build an artificial neural model of human colour-information processing which provides a much more accurate prediction of colour difference."

The neural system is presented with pairs of coloured surfaces and it measures the spectral data for the two surfaces and then predicts the size of the difference.

Predicting the dyes and pigments required to produce a certain colour is another big problem. Dr Westland said: "The task is traditionally carried out by trained colourists who use their skill and experience to 'guess' the recipe needed to meet the specification."

He said computer-based systems for predicting colour recipe are available. "But even these are far from perfect since they only crudely describe the optical properties of complex non-linear systems like paints."

Factors that contribute to the unpredictable world of paints include agglomeration of particles of pigment; and "particle hiding", where one particle of pigment hides behind another.

At Keele, researchers "train" neural networks to learn what formulations are needed to generate certain colours. Dr Westland said this is done by presenting the network with many examples of colours where the recipe is known and the colour properties measured. The network stores this information by adjusting the strengths of the connections between its artificial neurons. He likens the process to the way a trainee human colourist builds up knowledge and experience.

Dr Westland believes that it should be possible to integrate the kind of networks being developed at Keele into a manufacturers' production system. This would make the network sensitive to changes in variables such as water supply or colourant strength.

Kam Patel
Published: 28 March 1997