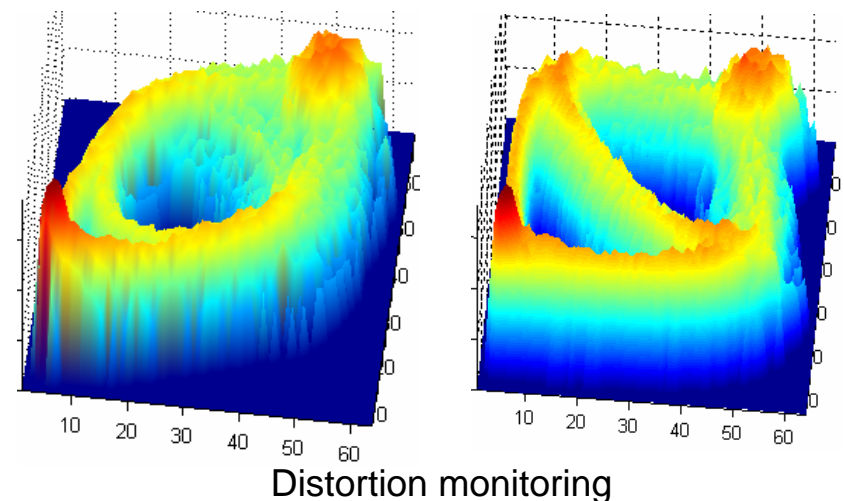
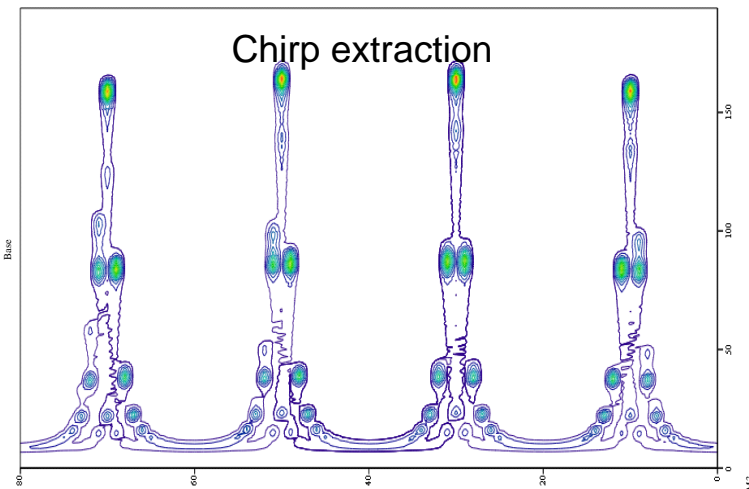


Optical Signal Monitoring (up to 4 projects)

Sarah Dods, Trevor Anderson, Peter Farrell & Kerry Hinton

Monitoring signal quality without electrical detection of the data is becoming a burning issue for optical networks. Our research team is developing novel and practical devices and techniques to meet this need, with the aim of commercialisation. Possible directions for students include optical experiments and simulations, artificial intelligence, control theory, and/or signal processing. Our current projects are:

- Direct measurement of optical signal to noise ratio
- Extraction of optical parameters from insensitive receivers
- Clockless distortion monitoring
- Correlation of error patterns with optical impairments.

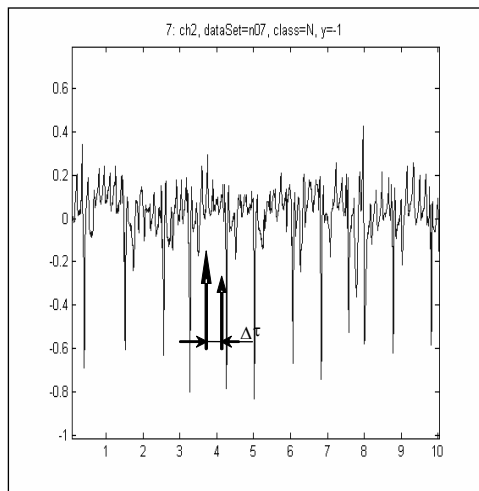


Complexity Tradeoffs in Data Analysis

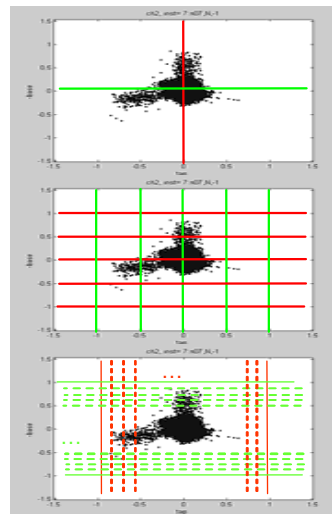
Sarah Dods, Adam Kowalczyk, Trevor Anderson,

Machine learning is a very powerful technique for analysing complex datasets, and we are currently applying it to the optical performance monitor we are developing. The projects in this area include:

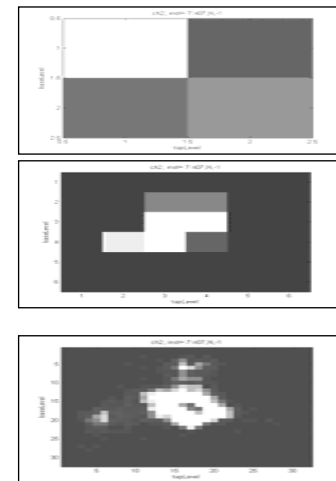
- Investigating the underlying theory of the system we are analysing, based on dynamical systems theory, and chaos theory. This will include the interplay between more complex measurement data (e.g. different numbers of data taps), and more complex analysis techniques (e.g. different binning effects).
- Comparing different machine learning techniques, including statistical machine learning, wavelets, and principle and independent component analysis.
- Applying these techniques to other areas, including medical applications



Time series



Phase portrait



Phase histograms

Polarization Mode Dispersion

Sarah Dods & Peter Farrell

Polarization mode dispersion (PMD) arises in optical communication systems due to imperfect circular symmetry in optical fibre. It can place severe limits on the performance of high bit rate systems, but is difficult to research because its effects in real systems are statistical and dynamically varying.

- PMD emulators have been developed to get around this problem by mimicking PMD in a controllable and reproducible manner on an optical bench. A lot of work has been done to understand the properties of these emulators, but they are not yet fully understood. This project will involve a detailed study of the structure of different PMD emulators, comparing their complexity with performance.
- We have assisted in the development of a new metric for the effects of PMD called string length. A project is also available in developing new instruments to measure string length in the field, and to improve our understanding of its relationship to other PMD metrics.

