One Day Study Group

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As part of its strategic plan for research, the University of Huddersfield is setting up an Institute for Mathematics and Data Science. To implement this vision it has hired Professors Fionn Murtagh and William Lee. The Institute (currently a Centre) will carry out research and teaching in mathematics with engagement with industry at the heart of its activities.

To kickstart the engagement with industry a one day Study Group with Industry was organised. The organising committee consisted for Professors William Lee and Fionn Murtagh from the Centre and Marie-Claire Micuta and Simon McKenna from the Business Development Office (School of Computing and Engineering). Additional support was provided by Rebecca Marsden, Kelly Jakeman, and James Devitt.

Figure 1: The event was opened by Professor Fionn Murtagh.

Three sources of financial support were found.

- MI-NET through the Industrial Workshop scheme.

- The University of Huddersfield through the CVF scheme.

- MACSI at the University of Limerick (where Prof Lee holds an Adjunct Professorship) covered transport and accommodation costs for a number of experienced study group participants to attend.

Charging industrial participants to bring a problem was considered but as this is the first such event held in Huddersfield this was considered counterproductive.

Figure 2: Paul Meikle-Janney presenting a problem on behalf of Dark Woods Coffee.

Academic participants were recruited by advertising locally within the University of Huddersfield and by invitation. The very compressed format, attempting to replicate the activity of a week long study group as much as possible into a single day, meant that the majority of participants needed to be experienced study group attendees.

Several strategies were used to source problems. Companies which had an existing relationship with the university were contacted, typically via academics who had contacts within those companies. Secondly the press office put out a press release to local newspapers. Finally companies working in areas the organisers had research expertise in were contacted even if there was no existing relationship. Of these, as expected, using existing contacts worked best, however cold calling did succeed in generating one problem on coffee modelling.

Figure 3: Experiemental work in brewing coffee.

Three problems were sourced. Saf Bhuta of Kirklees Council asked the group to look into whether Big Data methodologies could be used to improve Adult Social Care provided by the council. Paul Meikle-Janney from local coffee roasting company Dark Woods Coffee worked with a group on developing models of coffee brewing that could be of use to Baristas. (Paul provides Barista training for the Speciality Coffee Association.) Donald Burns from a local precision engineering company "Company A" was interested in whether analytic methods could be used to understand the electric field generated by a machined component.
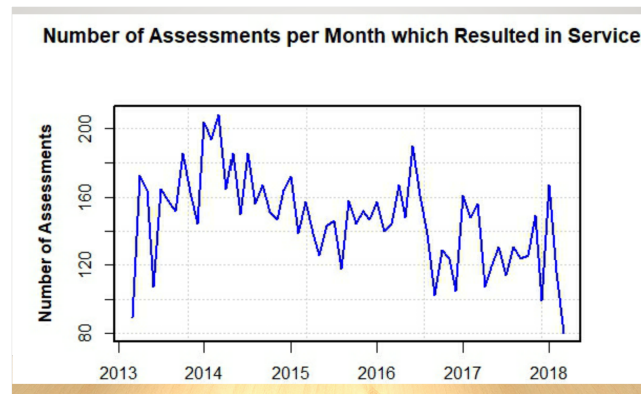
Figure 4: Time series data from Kirklees Council.

The format of the event followed the standard pattern of a study group. After an introduction to the event and format by Professor Murtagh, as shown in figure 1, industrial representatives were invited to describe their problems. Figure 2 shows Paul Meikle-Janney presenting his problem on modelling coffee. Following the presentations the participants broke up into groups to work on the problems. The work was mostly mathematical but the coffee group also performed some experiments, as shown in figure 3. Presentations summarising progress were given at the end of the day.

Figure 5: Describing an axisymmetric potential in terms of Bessel functions.

Figure 6: Using Richards equation to model the infiltration of water into a coffee grain.

On all three problems excellent progress was made during the day. For the problem brought by Kirklees council the team used a time series approach to modelling future demand and suggested a risk stratification model based on health status. Time series data is shown in figure 4. A strategy for addressing the Company A problem using perturbation theory was developed. A general solution

3

to the perturbed problem using Bessel functions is shown in figure 5. For modelling coffee in discussions between the group and Paul Meikle-Janney explicit modelling of water infiltration within a single grain was identified as an important next step in modelling and an approach based on Richards equation was outlined, as shown in figure 6.

In all cases next steps are for the organisers to write a short report on outcomes of the day and outlining suggestions for further work and potential mechanisms for funding that work. Professors Murtagh and Lee are planning to make the Study Group a yearly event and extend the duration to a week long event.