Can Artificial Intelligence algorithms help to exploit a new forest measurement system?

New technology from a Cork start-up company, TreeMetrics, means that trees can be measured more effectively, but how do you add value to this information for better decision-making? The Cork Constraint Computation Centre (4C) in the Department of Computer Science at UCC, together with TreeMetrics, is leading the race towards improved timber recovery.
Europe's forests are among the primary producers of wood in the world. They account for 23 per cent of the world's industrial roundwood sales and this from only five per cent of the world's forest area. Within Europe, over half the forests are designated for production, a much higher figure than the global average of 32 per cent, yet the industry is still sustainable with new plantations being grown faster than timber is being harvested. One result of this is that Europe is a net exporter of timber and has been since 1993.

What this tells us is that the European timber industry is performing well above its hectare level compared to the rest of the world, while at the same time remaining sustainable. However, to retain that position, Europe needs to develop improved timber recovery methods from the resources it has.

TreeMetrics and 4C believe they have the set of technologies to improve the measurement of forests, and through that, to achieve improved harvesting of timber logs, matching the requirements of the market. They have secured initial funding through Enterprise Ireland's Innovation Partnership in 2007 and already, the Scottish Forestry Commission and Coillte Ireland have funded separate evaluation studies for forests in their own countries. Other countries such as Sweden, Norway, Poland, Canada and USA, have also expressed serious interest in the technology generated by this Irish partnership.

From a research perspective, TreeMetrics and 4C have already been awarded the it@cork leadership award for R&D, 2007 (http://blog.itcork.ie/leaders-awards-winners/).

The collaboration between 4C and TreeMetrics has allowed the company to get to market early, ahead of competition in forest measurement and also with added value applications using this new information.

When a tree is harvested, the trunk will be cut into specific log lengths and delivered to the sawmill. How each tree is cut and where the resulting logs are sent, depends on the characteristics of trees, the demand for log lengths and the value of each log. This is the critical decision point in forest planning. Inefficient cutting and poor distribution decisions can lead to good timber being used to satisfy poor quality requirements, excess waste going to pulp, and dissatisfaction from the users. Both forest sellers and buyers can lose out through not knowing accurately what is in the forest and the best ways to access it.

Informed decision-making needs to be supported by good quality data and information. TreeMetrics provides this with its terrestrial laser scanning capabilities. Laser scanning technology has been traditionally used in the process engineering environment to detect layout of pipes, etc. Now, the same technology can be applied to forests and from the resultant ‘point cloud’ of data [Figure 1] image recognition software can be trained to recognise the shape of trees [Figure 2]. If scanning is repeated at sample positions throughout the forest, then the TreeMetrics system can provide an accurate ‘catalogue of the forest’. Through such technology, the forestry supply chain begins to resemble that of a manufacturing supply chain, with logs being produced in a predictable manner and according to demand and supply parameters. At this point, 4C is able to apply its many AI/optimisation technologies, algorithms and modelling capabilities, used in supply chain research, to determine the most efficient way of harvesting and distributing the forest resources.

TRIO (Timber Recovery using Improved measurement and Optimisation) is an Innovation Partnership project funded by Enterprise Ireland and TreeMetrics and awarded to 4C for the duration of 18 months. The Principal Investigator on the project is James Little, staff scientist at 4C and for TreeMetrics the CEO is Enda Keane. The full 4C team consists of Conor Nugent, Steve Prestwich and Tomas Nordlander. The project is structured into three segments of inter-related research, based around the TreeMetrics data. The first is to estimate the full tree trunk where missing data occurs due to branches, foliage and undergrowth, occluding parts of the tree. The second stage is to determine good ways of cutting the tree into log sizes required by the sawmills. The third and final part is to determine the optimal way of cutting a set of forests and to which sawmills to send what volume of the resulting logs. For longer term planning, they are also capable of modelling for the best time to harvest, taking weather and environmental restrictions into account.

4C, part of the Department of Computer Science, receives its core funding from Science Foundation Ireland. Its reputation arises from its capabilities of modelling complex problems for which no standard solution technique exists. The technology has been applied to areas as diverse as forestry, health, e-commerce, telecommunications and manufacturing. These are all areas in which 4C has active research projects. Other characteristics of the research are that these problems often contain uncertainty, ill-defined restrictions, multi-stakeholder objectives, and require a mixture of solutions.

Enda Keane, CEO of TreeMetrics, says: “the research collaboration with 4C and the support of Enterprise Ireland has enabled us to reach the market earlier and with a better overall product.”

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