In this issue

Pitfalls in Data Science

Statistics saves

The slow evolution of machine learning algorithms from the 1980s onwards underwent a rapid increase in rate from the second decade of this century and, now, suddenly, data science has become a new and dominant niche in scientific enterprise. Those who jump on the bandwagon must remember that all this was possible through advances in statistics accumulated over more than 150 years, points out Rajeeva L. Karandikar in a General Article in this issue.

Leveraging only on data, even when the volume is high, while ignoring the domain and the statistical learning, can lead to poor conclusions and costly mistakes, he warns. And he briefly recounts some historical examples to demonstrate the point. He also has advice on how to avoid the pitfalls of using artificial intelligence: back it up with human intelligence.

Those who are even remotely interested in the topic must turn to **page 1016** for some important insights.

Estimating Crop Production

For export–import planning

Agricultural output is the most critical factor for ensuring a country's food and nutrition security. When there is abundance, we can export and when there is a short fall, we will have to import. But then, most other countries would do the same. And since agricultural output is heavily dependent on meteorological factors which are not restricted by national borders and have regional impact, the rise and fall of agricultural commodities in the international market can fluctuate widely. If, however, we could predict crop production, we could estimate our needs in advance and plan for export or import well in time to avoid glut and shortages.

In a Research Article in this issue, researchers from the CSIR-Fourth Paradigm Institute present a deep learning method to do exactly this. They take rice, the most important food crop in the region, as a case study. Data on rice production in 21 Asian countries is available from FAO. The researchers collected data from 1961 to 2016, and used data from 1960 to 1990 for training a deep learning model based on artificial neural networks that contained a stack of long short term memory modules. They trained the model with as many possible combinations of rice production from neighbouring countries. Thus the researchers identified eight countries in Asia whose data on agricultural output are most useful to the deep learning model to estimate India's rice production.

Then the team tweaked the model further by adding rainfall data and assessed the value of doing so in refining the model. They put their model to test by examining the results in the light of the net flow in import–export data. The results are there for all to read, in the Research Article on **page 1073**.

Pollinating *Ficus elastica*

The wonder of wasps

Sexual reproduction in *Ficus elastica*, as in most other ficus species, is intricately linked to the life cycle of a specific wasp which lays eggs in the flower, a synconium, which looks more like a fruit to untrained eyes. The development from wasp eggs to larvae and adults takes place inside the synconia. The tree benefits from providing breeding grounds for the wasp by getting pollinated.

Researchers from IISc were examining the ecology of *Ficus elastica* in Meghalaya where the adventitious roots of the abundantly growing trees are intertwined to build living bridges across streams and chasms. And they found a curious phenomenon. Besides *Platyscapa clavigera*, the wasp that is morphologically specialised to pollinate the synconia of *F. elastica*, there is another wasp in the synconia, a *Micranisa* species.

Since the *Micranisa* species does not have the morphological apparatus to oviposit into the synconium from outside, the researchers surmise that the wasp must be entering the synconium through the osteole, a narrow opening on top of the synconium, to deposit the eggs.

The finding throws open some interesting questions. What specific role does *Micranisa* play in the reproductive biology of *Ficus elastica*? Since cases of finding *Micranisa* in synconia are rare, did the wasp species enter by mistake? After all, another ficus, *Ficus altissima* is known to be pollinated by a *Micronisa* species... Or is it that the wasp–fig connection is not as strict as was earlier thought?

In any case, the Research Article on **page 1099** in this issue is bound to provoke botanists, entomologists and ecologists in different measures.

Thermal Conduction in Nanofluids

Estimating using sound waves

The thermal conductivity of fluids can be manipulated by adding nanomaterials. Research on nanofluids is still nascent. Estimating the relationship between thermal conductivity and the amount of nanomaterials added to the fluid poses difficulties. A Research Article in this issue provides a simple method: using the velocity of sound to estimate the thermal conductivity of nanofluids, using the case study of aluminium oxide nanoparticles in water.

The authors point out the non-linearity in the phenomenon, the lack of applicability of micro-scale theories, and the need for a nanoscale theoretical framework to understand the properties of nanofluids. Read on from **page 1032**.

K. P. Madhu
Science Writing Consultant
scienceandmediaworkshops@gmail.com