



- PhD Title:** Remote and Automatic Monitoring of Bird Populations
- Studentship:** Full Scholarship, including fees (EU/Non EU) plus annual stipend of €18,000.
- Start Date:** Sept 2019
- PhD Supervisor:** Dr. Naomi Harte, Sigmedia Group, Electronic & Electrical Engineering, Trinity College Dublin, Ireland

Background:

The analysis of birdsong has increased in the speech processing community in the past 5 years. Much of the reported research has concentrated on the identification of bird species from their songs or calls. Birdlife International has identified over 12,000 sites globally that are home to bird species of conservation concern and other forms of biodiversity. Out of these, 422 are in danger due to a number of threats including human encroachment and climate change. One of the main challenges in properly managing these sites is adequately monitoring them to determine their state, threats to the ecosystem and responses to these threats. Remote monitoring is the best potential option to achieve the level of coverage required.

The objective of this PhD project is to define the next-generation approaches to the use of remote monitoring for populations of birds of conservation concern. This PhD programme will develop acoustic techniques for the monitoring of bird species of conservation concern by leveraging recent developments in speech and language processing technologies. The PhD will develop appropriate approaches to acoustic data collection in the wild to ensure that acoustic surveys yield accurate bird population data and investigate audio signal analysis steps necessary to extract useful information from these long recordings. In particular the student will focus on signal enhancement to mitigate noise, and the idea of diarisation, i.e. the concept of “who sang when”. This ambitious approach will take concepts from speaker diarisation in the speech processing domain and attempt to make sense of recordings overall. Birdsong presents significant challenges beyond speech, with more rapid pitch fluctuations coupled with noisier recordings in the wild. Thus the research is very far from a re-application of knowledge from one domain to another. Also, rather than trying to identify specific species in a recording from a closed set of possible birds, this approach will consider an unconstrained set to add to the technical challenges and make the results even more impactful. The desire is to exploit online archives of birdsong recordings from experts such as those available on xeno-canto.org and The Macaulay Library at Cornell. Based on the known geographical location of a recording, spontaneous models of bird vocalisations from populations in that area could be constructed using machine learning performed on available archived recordings. Techniques developed originally for speaker

identification will be further developed for this application. This work will also leverage deep learning to quickly build accurate models from these large datasets.

Envisaged Outputs of the Research:

- Signal processing algorithms to address noise issues specific to remote recordings in bird habitats.
- Exploitation of advanced machine learning approaches, including deep learning, to identify portions of recordings that contain bird activity.
- Disruptive approaches to automatic bird species identification to leverage opensource repositories to identify birds present in the recordings.

Requirements:

The ideal candidate for this position will:

- Have a primary degree (first class honours) in Electrical Engineering, Computer Engineering or a closely related discipline.
- Possess strong written and oral communication skills in English.
- Have a strong background and interest in digital signal processing (DSP)
- Have strong coding skills
- Be mathematically minded, and be curious about nature.

Interested candidates should send an email to Prof. Naomi Harte at nharte@tcd.ie. The email MUST include the following:

- Candidate CV (max 2 pages)
- A short statement of motivation (half page)
- Scanned academic transcripts
- Proof of English language competency (where applicable, see ¹)
- Name and contact details for TWO academic referees

Incomplete applications may not be considered.

¹ <https://www.tcd.ie/study/international/how-to-apply/entry-requirements.php#language-requirements>