

Detection of the bird song – a study on the collared flycatcher (*Ficedula albicollis*) with the help of deep neural networks

Sándor Zsebők¹, Máté Ferenc Nagy-Egri², Gergely Gábor Barnaföldi², Miklós Laczi¹,
Gergely Nagy¹, Éva Vaskuti¹, László Zsolt Garamszegi^{1,3}

¹ Department of Systematic Zoology and Ecology, Eötvös Loránd University, Budapest, Hungary

² Wigner GPU Laboratory, Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary

³ Institute of Ecology and Botany, Centre for Ecological Research, Hungarian Academy of Sciences, Vácrátót, Hungary

The animal bioacoustic investigations result enormous amount of digitized acoustic data, and we need effective automatic processing to extract the information content of the recordings. Our group is specialized for the song of collared flycatcher (*Ficedula albicollis*) and interested in the evolution of the animal acoustic signals. In the last 20 years, we obtained hundreds of hours of bird song recordings collected in natural environment, and we are seeking for automatic processing solutions. In this study, we chose an open-source, deep-learning image detection system (YOLO) to (1) find the specie's specific songs of the collared flycatcher on the recordings and (2) to detect the small, discrete elements within the song. For the two tasks, we transformed the acoustic data into spectrogram images, and we trained two deep-learning models separately on our manually labelled and segmented database. The results are outstanding in both tasks and anticipating an order of magnitude less human effort in the acoustic processing than the manual method used before. Thanks to the new technique, we are able to address new biological questions that need large amount of acoustic data.