BLIAIN LE BAISTEACH - SONIFYING A YEAR WITH RAIN

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ABSTRACT

In this paper the development of software for the creation of *Bliain Le Baisteach* is described. Over 77,000 datapoints were received from the Irish meteorological service. A neural network was designed and trained with 1,000 traditional Irish melodies. The data was then partitioned according to the four geographical provinces of Ireland and made to stimulate the network, generating the different parts of a score for the Irish Chamber Orchestra.

1. INTRODUCTION

Bliain Le Baisteach is a multimedia work. We are using both images and music, trying to show what is going on in our environment through both sound and images. In Bliain Le Baisteach you can experience many different things. The rainfall data is complex and chaotic by nature. Looking at the data just as numbers makes very little sense – endless lists of numbers. One can, of course, create a graph from the data, which gives you a visual diagram with hills and valleys, making more meaning than just the numbers. You can also look and listen to Bliain Le Baisteach on a micro – macro level. The sweeping patterns of weather systems coming in from the Atlantic in the satellite images are like looking at an oil painting at a distance. On the micro level, the rainfall data is like moving closer, looking at the individual brush strokes, although you are not looking at this level – you listen. If we had just made straight sounds or notes of the data, it wouldn't have sounded very interesting. By devising a neural network trained with traditional Irish music, you get the brush strokes reanimated.

2. NEURAL NETWORKS

In early 1999 we initiated discussions about the possibility of making music from rainfall data. The national Irish weather service, Met Eireann, was approached and they agreed to supply the daily rainfall data for the entire 1999 from 211 weather stations around the country. Back propagation neural networks (BPN) were developed and trained with some of the electronic corpora of traditional Irish folk music available in the Computer Science Department at UL.

The musical corpora had first been converted into MIDI and then analysed, forming the training set (TS) of melodies. None of the melodies were longer than 128 note events. Two BPNs were set up to have 128 outputs each (one BPN for pitch and another for duration). The pitch space was normalised (0…1, where 0 represented a note without pitch, i.e. a pause. The duration space was mapped so that 1 was whole note, 0.25 a quaver, etc. Training vectors were padded with zeroes for both pitch and duration. With 28 hidden units, the training of the BPNs converged.

The BPNs were trained with the TS with the inputs enumerating the melodies in the TS. This means that for the first melody in TS, the first input would be equal to one and all other inputs zero; for the second melody, the second input would be equal to one and all other inputs zero; etc. When tested, the network was able to recognise all of the melodies in TS.

In production mode, the normalised rainfall data was forced upon the inputs, which resulted in the network producing output vectors of 128 note events. As there was 365 sets of daily rainfall data, 365 x 128 notes were generated.

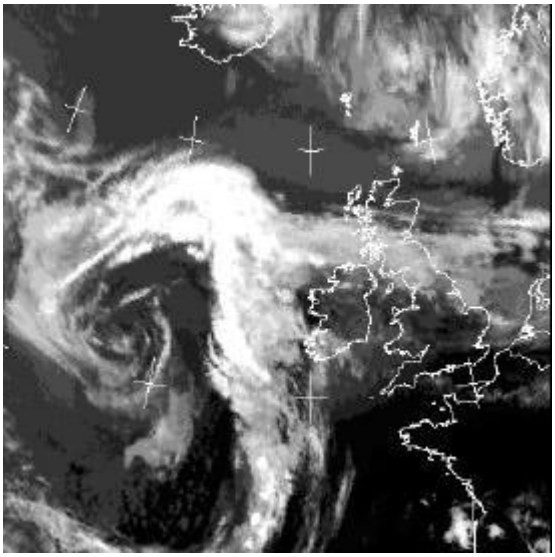
We also received all satellite images of Ireland for 1999 from Met Eireann (see Figure 1). The images were and stitched together as a video animation, to provide visual accompaniment to the music generated by the BPNs.

3. OUTPUT WINDOWING

To make the resulting piece more interesting, and to be able to create a playable piece of a particular length of time, a windowing program was designed that would grab fragments from the output vectors and traverse the output vectors from the first to the last while extracting fragments from proportional locations in the vectors. This means that at the start of the resulting piece, fragments where picked from the start of the vectors, while at the end of the piece, fragments were taken from the end of vectors. The windowing software also implemented some further playability aspects such as the possible range of

the target instrument. A note outside the range of a target instrument was transposed by octave(s) into a playable range. After the windowing process had rendered a final output, the result was converted back to MIDI.

Figure 1: Image from weather satellite



4. DISCUSSION

The software design and information architecture used in this project is interesting as the BPNs can be said to interpolate melody space *between* the tunes in the TS. If all inputs were forced to 0.5, the output would, in a sense, be the average melody of all TS. With a data set such as rainfall, there is little or no risk that, for example, the maximum rainfall would occur in a particular station, while no other stations had any (which would cause the BPN to produce an exact replica of a melody in TS).

While the BPNs in principle produce a unique melody for each input vector, up to 128 note events long, the combination with the Output Windowing provides a feature to create musical compositions of arbitrary length. This, of course, affects phrasing and structure, but in general it has proven to be a highly productive tool.

The melodies in the TS were in different keys, or modes, and of different time signatures. As it happens, most of the melodies in the TS were in D, G, and A. Most of the TS were jigs and reels, plus some slip jigs and slow airs.

The parameters of the Output Windowing process determine the format of the resulting piece, hence it can be set to produce various time signatures. The final piece was rendered to be 9 minutes long.

The issues of key and dynamics and some few adjustments for playability were added manually in a musical score annotation package.

5. CONCLUSIONS

In this paper we have presented a creative technique to make music from arbitrary numerical data sets, flavoured by previous knowledge of a musical style (or styles) of a training set of music. This technique has proven to work quite well, as the resulting work was playable by the Irish Chamber Orchestra and was chosen to be one of the centrepieces in the Irish Pavilion at EXPO2000 in Hanover. Finally it was performed live in the University Concert Hall in the University of Limerick and broadcast live via the Internet. The work has also been broadcast on some national radio stations and international TV stations, and listeners have reported their appreciation and recognition of the piece.

6. WEB RESOURCES

Further information about the project can be found at the web site www.softday.ie

7. ACKNOWLEDGEMENTS

The authors would like to thank the Irish Art Council for the kind support of the project. Thanks to Dr. Donncha O Maidin for access to music corpora. Many thanks to Met Eireann for providing the rainfall data and satellite images. Finally, great thanks to John Kelly, Fionula Hunt and all the excellent musicians in the Irish Chamber Orchestra for rehearsing, recording and performing *Bliain Le Baisetach*.