AUTOMATED IDENTIFICATION OF MELODIC VARIANTS IN FOLK MUSIC

MARTIN DILLON and MICHAEL HUNTER

Introduction

The idea of automatically identifying musically related melodies is not new. As early as 1949, Bertrand H. Bronson suggested the use of machine-readable encodings of the initial phrase of songs (the incipit) as an aid in the study of variation in music. Since that time, the increasing acceptance of DARMS (Erickson, 1975) as a system for encoding music opens the tantalizing prospect of a general procedure for automatically identifying musically related melodies. A typical application, and the motive for the research reported here, arises in the repertory of the American shape-note hymnody, a body of music created by and for the singing school tradition, a thriving musical and social feature of rural America in the 18th and 19th centuries (Chase, 1966). Shape-note tunes are the earliest transcription into music notation of widely ranging melodies adapted from oral tradition and later compiled in book form. The repertory raises a number of interesting questions concerning the nature of musical variation, including its precise definition, and thus represents a fine environment for investigating the feasibility of automatic matching of melodic variants.

Before explaining a method developed for automatic variant matching in the tunebook repertory, let us first consider two other general approaches to the same problem: the thematic index, especially in the form advocated by Harry B. Lincoln (1968), and the measure of association.

Thematic index

This means of locating a melody when its first few measures are known may, for example, provide additional information about the melody such as its composer or source. In this respect, the thematic index is like a dictionary for words, and like a dictionary, its success depends on the degree to which a melody can be found easily in the index. Thus, entries in such an index must be ordered so that one may search for an individual melody systematically and find it quickly. Different orderings are possible, depending on how a melody is represented. One obvious approach is to represent the notes by their traditional alphabetic equivalents, in which a melody in the key of C for example, would be represented by the letters C, D, E, F, G, A, and B. A collection of melodies can then be alphabetized following rules similar to those used in ordering words in a dictionary. (Some accommodation must be made for chromatic alterations, i.e., for notes falling between those represented by the letters.)

If an index is to be used effectively for research into melodic variation, however, this simple strategy is not workable. In these cases, the same melody represented in two different keys, say C and G, would be widely separated. To overcome this deficiency, the most obvious strategy transposes each melody into some standard key, usually C, as for example in Barlow and Morgenstern's Dictionary of Musical Themes. One can carry this strategy further, as does Lincoln in the index.
mentioned above. Concerned more with the broad contours of a melody than with its precise pitches, Lincoln represents the intervals of a melody rather than its individual notes. Thus, a sequence of notes such as ‘C E G C’ is converted to the intervals between the notes, that is, ‘+3 +3 -5’. An ordering of melodies so represented facilitates variant matching by drawing together in the index all melodies that begin with the same interval, regardless of key. Benjamin Suchoff (1968) pursues this approach in the study of variants in the folk song repertory.

A thematic index for a collection of melodies, however derived, is limited in its effectiveness as a tool for identifying variants. When variation occurs at the beginning of two melodies, they will be separated in the index no matter how alike they are thereafter.

Measure of association

A second general approach to automatic variant matching based on a measure of association between two melodies can overcome this drawback. Wolfram Steinbeck (1976) suggests that the essential properties of a melody, such as its meter, its first and last notes, highest and lowest notes, and others, can be abstracted from a melody and represented in a form suitable to the calculation of such a measure. Individual properties can be weighted to reflect their importance to musical variation, as disclosed by empirical studies. Many formulae exist for reducing the shared property list of two entities to a single value reflecting their similarity, and one of these could then be applied to an appropriately encoded property list of two melodies. (See Nicholas Jardine and Robin Sibson (1971) for a discussion of this and related matters; it is likely that more than one formula would give equivalent results.)

The example presented by Steinbeck uses the single property of like notes, after both melodies have been transposed to a standard form. The melodies are aligned, typically starting from the first note; a simple measure might then be the percentage of identical notes in the two melodies. In contrast to an index, differences at the beginning of the melodies count no more than differences elsewhere. Stressed notes, usually of more importance in melodies and in variant melodies, could be weighted to contribute more heavily to the measure; a match on stressed notes could be given a weight of 2, let us say, with a value of 1 counted for a match of unstressed notes. The degree of association between any two melodies would range between 0 and 100%; the higher the score, the more likely that two melodies are variants. (There is more subtlety to the technique as described by Steinbeck, but this should give the basic idea. See Deborah and Philip H. Scherrer (1971) for a somewhat different route to the same goal.)

Measures of association have much to recommend them in the automatic identification of melodic variants, but they are unlikely to provide a complete solution. Such techniques lead to results that are interesting but often impractical. Calculating measures of association for thousands of items, for example, is feasible but quite expensive, even using today’s computers. A more serious obstacle to their general use, in this and similar applications, is the difficulty in making sense of the results. Cluster analysis, a sophisticated technique for grouping items related through a measure of association, as suggested by Steinbeck, has rarely been used with success on large data bases of any description. In general, the more subtle and numerous the properties on which a measure of association is based, the more difficult their manipulation, comprehension, or in the case of weak or unacceptable results, their improvement. Steinbeck, for example, after posing the problem of determining an appropriate set of musical properties and their effective weighting, a necessary prerequisite in such attempts, does not solve it.

Automated identification of melodic variants

Thus, each of the two major techniques for automatic variant matching – the thematic index and the measure of association – is deficient for a different reason. The thematic index is too rigid and fails to group variants when the variation occurs