QBH SYSTEMS CONSIDER tens of thousands of themes, a feat few humans without experience with music retrieval can match.

some researchers use intervallic distance (such as the number of half steps between successive notes) rather than absolute pitch. To account for differences in vocal range, representations of themes and queries generally discard much of the octave information and restrict melodies to a range of one or two octaves. VocalSearch uses intervallic distances and represents rhythm by the ratio of note durations. The figure outlines an example of a theme from the Beatles' "Hey Jude"; the number of half steps between adjacent pitches is encoded as an integer, while the duration of the second note, relative to the first, is encoded as *longer* (L), *shorter* (S), or *equal* (E).

CONCLUSION

Despite these technical hurdles, QBH systems work remarkably well. Many researchers have reported results showing good performance in terms of processing time, precision, and recall. For example, [10] reported results near human performance on a Beatles database. QBH systems have been used on a trial basis over the past few years in music libraries [6]. The third author regularly uses VocalSearch to access his own personal digital music collection. Meanwhile, technologically interesting applications for personal music libraries, music education, and karaoke systems are becoming possible. While humans are still better at recognizing sung queries, QBH systems continue to improve and can consider tens of thousands of themes, a feat few humans without experience with music retrieval can match. **C**

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