Mapping areal variation and majority language influence in North Sámi using hierarchical prosodic analysis

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This paper presents the results of a statistical hierarchical analysis of areal variation in prosody of North Sámi language. The hierarchical analysis method compares unigram models using cross-entropy measure. The models depict distributions of Δ-features of $f_0$ and energy signals decomposed using Continuous Wavelet Transform [1]. These signals are obtained from speech recordings of five areal North Sámi varieties recorded in sites in Northern Finland and Norway (the Finnmark area) [2, 3]. As the used method does not require any extensive labeling or annotating, the method is especially suitable for under-resourced languages with limited speech material.

We evaluate three potential sources of variation in prosodic characteristics of these five areal varieties: (1) traditional dialectal analysis of North Sámi (2) influence of the relevant majority languages, and (3) geographical distance. Our results show a significant positive correlation between cross-entropy distances among models and geographical distances among recording sites, demonstrating a viability of the method for typological analysis. Prosodic characteristics of the areal varieties are also influenced by majority languages, and, to a smaller degree, by differences between the Finnmark North Sámi dialectal characteristics (Western and Eastern dialect groups, which have several phonological as well as phonetic differences [4]).

The bilinguality of the North Sámi speakers, migration of the Sámi people away from their traditionally inhabited areas and the effect of growing mass-media are all factors that inevitably influence the North Sámi spoken language. This challenges the traditional dialectological analysis [4], which previously has not taken the majority language influence into account. Our analysis reflects this majority language influence on the five areal varieties (Kautokeino, Karasjoki spoken in Norway, and Ivalo, Inari and Utsjoki spoken in Finland). Also, the geographical distance seemed to positively correlate with the similarity of the spoken language varieties in terms of prosodic characteristics, such as stress and intonation patterns.

The next step in developing our method for prosodic typology will be to investigate more thoroughly the sources of the differences between the areal varieties. This will be done by detecting the particular prosodic patterns that contribute most to the cross-entropy value. According to our preliminary hypothesis based on comparisons between Kautokeino and Utsjoki models, certain patterns likely to occur in Utsjoki, but not in Kautokeino are presumably connected with general sentence intonation and word stress patterns in Finnish and Norwegian [5, 6]. For example, a combination of a falling $f_0$ and rising intensity occurring at least in the Utsjoki variety from the Finnish Sámi can be explained by the influence of generally falling neutral sentence intonation in Finnish. In contrast, the Norwegian sentence intonation tends to be rising towards the end and also the word stress patterns are slightly different from Finnish, not to mention the effect of the pitch accent in Norwegian.

References: