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3

Allophonic Variantion in English and Their Implications for Phonetic Appkication

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ABSTRAK
Bahasa Inggris /1/ secara tradisional telah diklasifikasikan menjadi setidaknya dua alofon, suku kata yang lebih mudah yang biasanya didahulukan, dan dark, yang merupakan suku kata terakhir. Ketika ia menemukan vokal /1/s yang mendahului kemungkinan fonetik batas fonetik antara dua ekstrem, sebagian besar peneliti akhirnya berasumsi bahwa alofon fonem adalah unsur-unsur yang berbeda secara kategoris. Artikel ini memperkenalkan data mikrobeam akustik dan sinar-X untuk bahasa Inggris /1/, sebelum dan sebelum batas fonologis, terkait dengan /i - 1/. Utama tingkat kontras terang-gelap dari artikulasi muncul sebagai berikut: (1) retraksi yang lebih besar dan penurunan lidah untuk varian punggung /l/ yang lebih gelap; (2) kejadian lebih awal pada versi yang lebih gelap dari /1/ retraksi dorsal dan penurunan ekstremitas relatif terhadap peningkatan ekstrim apikal dibandingkan versi waktu yang lebih mudah /1/ di mana tungkai belakang lebih lambat dari pada ekstremitas puncak. Dapat juga dilihat bahwa kegelapan /1/ adalah dengan langkah-langkah artikulasi di atas dan tindakan frekuensi formant - berkorelasi kuat dengan akustik terukur durasi sajak yang mengandung awalan /1/. Kami menafsirkan hasil kami sebagai bukti bahwa tidak ada alasan untuk pengobatan alofon terang dan gelap secara fonologis berbeda (atau fonetik) entitas dalam bahasa Inggris. Alih-alih, singular fonologis, entitas /1/ secara fonetis direalisasikan sebagai varian yang lebih terang atau lebih gelap tergantung pada faktor-faktor seperti posisi /1/ dalam suku kata, dan durasi fonetis dari konteks prosodik yang mengandung /l/. disarankan bahwa /1/s mengandung gerakan vokal belakang serta gerakan puncak konsonan. Sebaiknya gerakan vokal memiliki afinitas yang kuat terhadap suku kata inti, sedangkan untuk gerakan konsonan memiliki afinitas yang kuat terhadap margin. Dua gerakan dari: /1/ jadi pada dasarnya gerakan suara asinkron datang melalui suku kata terakhir sebelumnya (yaitu /1/s yang paling dekat dengan titik). Tanda konsonan, dan keadaan sebaliknya tetap suku kata awal /1/s. Agar penjelasan ini berhasil, implementasi fonetik harus memiliki akses ke informasi dalam suku kata posisi elemen fonologis. Kami akan membicarakannya sebagian besar korelasi disebabkan oleh koartikulasi underdrive dengan durasi kegelapan.

ABSTRACT
English /1/ has traditionally been classified into at least two allophone, the easier syllable that usually comes first, and dark, which is a syllable finally . As he found out the vowel /1/s preceding the possible phonetic boundary phonetic between the two extremes, most researchers have end to assume that allophones of phonemes are categorical different elements. This article introduces acoustics and X-rays microbeam data for English /1/, before and before phonological boundary, in relation to /i - 1/. Main the degree of light-dark contrast of the articulations appears as follows: (1) greater retraction and lowering of the tongue for a darker back variant of /l/; (2) earlier occurrence in the darker version of /1/ dorsal retraction and lowering of the limb relative to the apical extreme improvement over easier timing version /1/ in which the hind limb is slower than apex extremity. It can also be seen that the darkness of /1/ is a with the above articulation steps and formant frequencies action - strongly correlated with measured acoustics the duration of rhymes containing the prefix /1/. We interpret our results as evidence that there is no reason for treatment light and dark allophones are phonologically categorically different (or phonetic) entities in English. Instead, phonological singular the entity /1/ is phonetically realized as a lighter or darker variant depending on factors such as the position of /1/ in the syllable, and the phonetic duration of the prosodic context containing /l/. it is suggested that /1/s contains back vowel movement as well as a consonant peak motion. We recommend that the vocal movement have a strong affinity for the core syllable, while for the consonant movement has a strong affinity for margin. Two gestures from: /1/ so basically asynchronous sound movements come through the last syllable before it (ie the /1/s closest to the dot). Consonant sign, and the reverse situation remains iinitial syllable /1/s. For this explanation to work, phonetics the implementation must have access to the information within the syllable the position of phonological elements. We will talk about it most of the correlation is caused by the coarticulation of the underdrive with the duration of darkness.

INTRODUCTION

The purpose of the research is presented in the article find an efficient feature vector that activates the auto assignment of allophones extracted from English speech corresponding phonological group. Learning should be presented in the context of variations developing another methodology for the /l/ allophone consonant allophone. Available parameter set describe the lateral allophone pronunciation model. Lateral allophones were chosen for the analysis because this linguistic phenomenon is very difficult for Polish speakers. Someone for decades observe the continuous development of technology voice recognition system. This is caused by several factors. One of these is the construction of an audiovisual speech corpus where there is quick camera recording and video analysis (visemes) supports voice recognition (Almajai et al., 2016; Cooke et al., 2006; Dalka et al., 2014). This affects both English and national language databases (Czyzewski et al., 2017b; Kunka et al., 2013; Benezeth et al., 2011; Trojanova et al., 2008; Zelasko ˙ et al., 2016; Kłosowski, 2017). For the audio part, the speech is a slow and normal speech rate; may also contain prosodic features to enhance the learning process audiovisual speech recognition system. More recently effective machine learning methods have also appeared for speech analysis and recognition (Almajai et al., 2016; Jadczyk and Ziółko, 2015; Marasek and Gubrynowicz, 2005; Brocki and Marasek, 2015; Aubanel and Nguyen, 2010), such as deep learning (Mroueh et al., 2015; Noda et al., 2015). Plus, new interests published in the phoneme-level-based analysis Czyzewski, 2013; Ziółko and Ziółko, 2009; Cooke et al.,2006) with applications in various fields, such as biometrics (Czyzewski et al., 2017a).

A unique feature of the audiovisual database (Fox et al., 2005) by Multimedia Systems Department at the Gdansk University of Technology a fixed list of specially selected words contains a wide variety of allophones, thus allowing a more thorough analysis of speech sounds. Because The purpose of the experiment is a series audio-video recordings were made to collect them necessary information. Experimental framework It is briefly described in Section 2 of the current study focuses on sound analysis. Edited audio files and segmented into allophones and then parameterized with the help of set of descriptors. This is presented in Part 2 a complete list of sublists containing different words the allophone of /l/ was selected for detailed analysis.As mentioned earlier, the reason for this research aims to provide a methodology for the analysis of allophones and automatic assignment of selected allophones corresponding phonological group. Analysis involving native speakers (standard South British or SSrE – Southern British Standard English; both men and women) and in the final stage admissions a non-native speaker. The indicated accent phonologists are also close to the original SSBrE (Standard Southern British English) and its segmentation the distribution of dark /l/ in South African English as well same as in SSrE. In dispute phonological characteristics of the evaluated audio material.

THEORETICAL BASIS

Allophonic material. It was observed that, at the level of conscious awareness, listeners ar characteristically attuned only to the distinctions between phonemes. Making speakers aware of allophonic variation requires that their attention be carefully directed to the distinction (Giegerich, 1992). An example of such phonological problem in English is the allophonic variants of the phoneme /l/. The group includes velarized (dark) [ë], which is articulated with the back of the tongue raised towards the soft palate and occurs word-finally or before another consonant (e.g., ball, fool, all, etc.), dental [l] instead of alveolar when a th consonant follows (e.g., wealth, health, stealth, etc.), fully devoiced /l/ when the preceding consonant is voiceless (e.g., slight, flight, plow, etc.) and partially devoiced word-initially, whereby the (clear) [l] onset is voiceless and voicing starts at the end of the /l/ articulation (e.g., listen, lose, allow, etc.), and partially devoiced word-final (dark) [ë], whereby the allophone is devoiced only towards the end of its articulation. In the production of the dark /l/, the front constriction of the tongue tip is accompanied by a post-dorsal or pharyngeal gesture, which results in observable lowering of the formant frequencies level L2. (second formant level) and rising of L1 (first formant level) (Giles and Moll, 1975). The variants of /l/ depend on the position of the tongue in the mouth. These differences result in very different formant frequencies. Recordings. A special system consisting of video and audio modalities was prepared, although in this study the authors focus on audio recordings only.

The audio files were recorded with a 48 kHz/16 bit resolution with three microphones (an LAV microphone and two condenser microphones situated 50 and 100 cm away from the speaker). Speech samples of 16 speakers (non-native English speakers, as well as English native speakers and a phonology expert) were recorded. For the purpose of this study, seven speakers were selected (Table 1). Four of them are native English speakers with a British accent (Standard Southern British or SBrE), Speaker D is native with a South African accent, and Speakers A and F are near-native phonology experts. As mentioned before, the accent demonstrated by the phonology experts is also near native SSBrE, and the articulation and distribution of dark /l/ in South African English is the same as in SSBrE. From the recorded dataset of over 600 words, a list of 103 words containing the lateral phoneme was compiled. The list includes 51 'dark' (velarized) allophonic realizations before a consonant or word-finally and 52 'clear' allophonic realizations before a vowel, including different places of articulation and voicing variants (Tables 2 and 3).

A total number of 721 samples was collected. Parameterization Before the parameterization phase

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took place, the first task was to locate the individual allophones of /l/ in all selected words, edit them, and then annotate them phonologically. Therefore, the /l/ allophones were extracted from all selected words. Indexation was performed manually by a sound engineer experienced in dialogue editing and familiar with English allophony. However, since the accuracy of indexation may have influence on the parameterization and final results, all measurements and indexations were performed with meticulous care and double checked. An automated segmentation system could not be used (Makowski and Hossa, 2014) since there was a need for allophone-focused editing.The duration of extracted /l/ allophones ranges from 30 up to over 200 milliseconds. Such a very detailed analysis of a speech phenomenon may also be useful in automatic detection of voice pathologies (Panek et al., 2015), requiring the editing process to be manual. The goal of the presented study was to find a vector of features that are related to differences between dark and clear variations in the lateral phoneme /l/. Therefore, an extensive set of over 200.

RESEARCH METHODS

The method used in this research is Classroom Action Research (CAR), which focuses on classroom situations, or commonly known as classroom action research, the procedure used is in the form of a cycle. Ward (Wardhani, 2013) classroom action research is research conducted by teachers in their own classes through self-reflection, with the aim of improving their performance as teachers, so that student learning outcomes increase. In this PTK the researcher used the Jhon Elliot model so that each cycle consisted of four main activities namely: planning, acting, observing, and reflecting.

RESULTS AND DISCUSSION

Results

Automatic evaluation of dark /l/ pronunciation At this stage of the experiment, dark /l/ performances of non-native English speakers were analyzed using Time+SPEC+modMFCC vector of features. Recordings for nine non-native speakers of 11 words containing dark /l/ listed in Table 12 were executed. The performance of speakers was evaluated by a phonology expert and treated as a ground truth for automatic classification. The data set consisted of 190 dark /l/ performances, including 44 incorrect trials. The conducted study allowed determining the set of features describing correct dark and clear lateral allophones; the ANN, kNN and SOM methods were implemented to analyze whether non-native performances fit into dark /l/ criteria. The accuracy of these analyses is presented As can be seen, apart from accuracy, three additional performance measures were calculated. Precision and recall give us exactness and completeness of the classifiers, respectively, while the F1 score shows us the balance between precision and recall. In order to determine whether the apparent differences in performance of the algorithms are statistically significant, McNemar's test is used (McNemar, 1947). Gillick and Cox (1989) recommend to use it in comparison of algorithms that classify isolated words. This was the main reason for choosing this test.Between the ANN and SOM as well as between the ANN and kNN are considered to be extreme cases of statistical significance. Meanwhile, the differences between the SOM and kNN are considered to be statistically insignificant. This means that the SOM and kNN algorithms have more errors in common compared with ANNs.

Discussion

Conclusions The results obtained in this study show that utilizing parameterization as a pre-processing stage in the classification process enables an automatic assignment of selected allophones of lateral /l/ to appropriate phonological group with high accuracy, i.e., over 98% for the ANN, 95% for the kNN and over 80% for the SOM. Also, the results demonstrate that the proposed set of parameters represents differences between dark and clear /l/ allophones. The ANN, kNN and SOM accuracy for all speakers, male and female, was the highest for the selected time and frequency domain-based parameters supplemented with the modified MFCCs constructed by the authors. Phonetic experiments showed that dark /l/ is characterized by observable convergence of formants F1 and F2 compared with clear /l/. This is in line with the current automatic classification, which uses energy distribution in consecutive signal bands.

The study shows that the PCA did not improve the SOM clustering accuracy for the performed study. However, this should be further checked with other group of allophones, as the PCA typically helps to constrain data redundancy and at the same time improves accuracy. The results obtained in this study lead to the conclusion that a separate analysis for male and female speakers is possible. Noteworthy is the fact that better accuracy was achieved for female speakers, although due to the limited number of speakers these observations cannot be considered a general rule. The analysis conducted separately for individual speakers shows remarkable differences among them. It was also observed that some speakers' utterances were more difficult for all classifiers (e.g., Speaker F). Although the lowest accuracy was achieved with SOMs, they still returned a high accuracy between 70% and 80%. Compared with the ANN and kNN methods, which require supervised training (92–98% accuracy for best performing feature vectors), the SOM-based results are promising and will be included in further research.An application of deep learning is also planned, although it would need a recording of a much larger spoken material volume, and this, in turn, entails big effort required for its annotation. Finally, making the annotating process along with feature space extraction automatic would also need approaches used in big data analytics. As described by Stefanowski et al. (2017), deep neural networks may help in automating tasks such as feature space construction, as this becomes an inherent part of the training process. However, this is true from the big data perspective: in the case of a classical approach to automatic speech recognition (ASR), instead of performing feature extraction, it is possible to use 2D feature spaces derived from signal spectrograms. In this way the data representation grows considerably and it makes it possible to use a 2D feature representation along with convolutional neural networks (CNNs) in the speech/allophone automatic recognition process (Korvel et al., 2019). We will work on these issues in the future.

CONCLUSIONS AND RECOMMENDATIONS

The results obtained in this study show that utilizing parameterization as a pre-processing stage in the classification process enables an automatic assignment of selected allophones of lateral /l/ to appropriate phonological group with high accuracy, i.e., over 98% for the ANN, 95% for the kNN and over 80% for the SOM. Also, the results demonstrate that the proposed set of parameters represents differences between dark and clear /l/ allophones. The ANN, kNN and SOM accuracy for all speakers, male and female, was the highest for the selected time and frequency domain-based parameters supplemented with the modified MFCCs constructed by the authors. Phonetic experiments showed that dark /l/ is characterized by observable convergence of formants F1 and F2 compared with clear /l/. This is in line with the current automatic classification, which uses energy distribution in consecutive signal bands. The study shows that the PCA did not improve the SOM clustering accuracy for the performed study. However, this should be further checked with other group of allophones, as the PCA typically helps to constrain data redundancy and at the same time improves accuracy.

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