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論 文 内 容 要 旨

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報告番号	甲 先 第 １９３ 号	氏 名	神内 教博

学位論文題目	New Similarity Scale to Measure the Difference in Like Patterns with Noise 「ゆらぎ」をもつパターン間の「ずれ」を検出する新しい類似性尺度

内容要旨

A new similarity scale called the Geometric Distance, that numerically evaluates the degree of likeness between two patterns is proposed. Traditionally, the similarity scales known as the Euclidean distance and cosine similarity have been widely used to measure likeness. Traditional methods do not perform well in the presence of noise or pattern distortions. In this paper, a new mathematical model for a similarity scale is proposed which overcomes these limitations of the earlier models, while improving the overall recognition accuracy. Experiments in speech vowel recognition were carried out under various SNR levels in a variety of noisy environments. In fact, at a SNR of 5 dB in a subway, the recognition accuracy improved from 65% to 75% and at 20 dB SNR from 98.4% to 99.6% over the MFCC method.

Furthermore, we describe that there are the following three shortcomings with the above geometric distance algorithm. (1) Since standard and input patterns are normalized to have the same area, a pseudo difference in shapes occurs between them. (2) Since "shape variation" is calculated in each combination of the standard and input patterns, the processing overhead increases when the number of standard patterns increases. (3) Since reference patterns are evaluated for each movement position of a normal distribution, the computational memory overhead increases when the number of components of standard and input patterns increases. To counter these shortcomings, a new geometric distance algorithm is proposed. Experiments in vowel recognition were carried out using the same voice data as the above experiments. At a mean of 5 dB SNR, the recognition accuracy improved from 78% to 82% over the above algorithm.

Moreover, in the above algorithm, we have performed the optimization using the "clean vowels in the continuous speech" for vowel recognition. However, there is a shortcoming with the above optimization method because only the clean vowels are used. To improve the shortcoming, we propose a new optimization method using the weighted random numbers generated by the computer and five patterns of long vowels. By using our proposed method, we have performed evaluation experiments for the "long vowels with actual noise of 5 dB SNR" and achieved the vowel recognition accuracy of 80.3%. We have verified the effectiveness of the proposed method.

論文審査の結果の要旨

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学位論文題目

New Similarity Scale to Measure the Difference in Like Patterns with Noise
「ゆらぎ」をもつパターン間の「ずれ」を検出する新しい類似性尺度

審査結果の要旨

　博士学位主論文は，*International Journal of Advanced Intelligence* に掲載されている．その内容は，新しい類似性尺度に基づく特徴抽出法の提案と音声認識での有効性評価を行ったものである．

　従来の類似性尺度はユークリッド距離やコサイン距離に基づくため，パターンのゆらぎ（ノイズの存在やパターンの歪み等）に弱かった．提案手法はゆらぎの存在する状況で，パターン間の「ずれ」の検出に関し従来法（MFCC法）よりも優れている．また，ゆらぎのない状況でも従来法よりも優れた結果を与えることが可能な新しい幾何学的距離アルゴリズムを提案し，精度の改善に成功している．さらに，重み付き乱数値を用いる新しい最適化法が提案されており，ゆらぎが含まれる長母音に対する有効性が検証されている．

　以上，本学位論文は工学の広範な分野で使用可能な新しい類似性尺度に基づく特徴抽出法を提案し，その有効性を検証しており，重要な価値を持っている．本論文は博士（工学）の学位授与に値するものと判定する．