論 文 内 容 の 要 旨

博士論文題目： Surface Electromyography Derived with Electrode Grid from Submental Region and its Application to Vowel Recognition
（格子状電極を用いたオトガイ下部からの表面筋電図計測および母音認識へのその応用）

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（論文内容の要旨）

Speech of dysarthric patients becomes slurred and makes communication difficult. However, communication assistance methods for dysarthric patients have not been established enough yet. There are great expectations to develop a novel assistance method. In fact, there are various researches done on the communication assistance. One of those is a study by Deng et al., which showed the effectiveness of the speech recognition based on surface electromyography (sEMG). However, electrode locations used in those previous studies are still controversial. This is because disc electrodes or parallel bar electrodes were used in those studies. Although such electrodes are commonly-used, they cannot avoid deterioration of signal-to-noise ratio caused by the influence of innervation zones and crosstalks, which must be taken into account for determining the electrode location.

sEMG measurement using an electrode grid which has multichannel is used as an effective method to cope with the problems caused by innervation zones and crosstalks in the electro-physiological researches. In this dissertation, we introduce the use of electrode grid based measurement to speech recognition based on sEMG and investigate whether this measurement method is effective or not. Producing five vowels and submental region are employed as the experimental task and measurement site, respectively. The reason why we choose the submental region is that electrical activity of muscles which control the movement of tongue can be measured partly from it.

In this dissertation, first, we illustrate that the positions of innervation zones of superficial muscles can be estimated by using an electrode grid. Second, we investigate the feasibility of vowel recognition based on sEMG derived with electrode grid and show that vowel recognition can be realized to some extent from sEMG signals of submental region. And lastly, we describe the results of applying sparse discriminant analysis to the sEMG signals which can contain redundancy. Thus, it is shown that redundant channel can be removed by the proposed method.

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（論文審査結果の要旨）

脳卒中などの後遺症の一つとして構音障害がある．発話が不明瞭となりコミュニケーションに支障を来すため，その支援方法の開発への期待は高い．本研究は表面筋電図信号に基づいた音声認識法の提案であり，音声合成技術と組み合わせることで発話を実現できる．

筋電を用いて音声認識ができることは従来から知られていたが，その配置の妥当性や頑健性に問題があった．本研究では多計測点を有する格子状電極を用いることで，SN 比を低下させる原因となる神経支配帯やクロストーク等の影響を低減できることを示した．格子状電極を頤下部に設置することにより，神経支配帯の位置を特定することができる．

さらに，そこで得られた信号により，母音認識が可能であることを示した．ここでは疎判別分析の手法を利用することにより，計測信号の冗長性を効率よく削減し，認識精度を高めている．また冗長性の除去は，計測チャネルの削減の可能性も示している．

以上をまとめると，本論文は，構音障害者のコミュニケーション支援に重要な音声認識技術について，格子状電極の利用の有効性を示し，さらにその利用法を提示，性質を解析しており，構音障害者支援システムの開発に大きく寄与するものである．したがって，博士（工学）の学位に値するものと認められる．