

論文内容の要旨

博士論文題目 Study on Participatory Activity Tracking and Risk Assessment
for Anonymous Elderly Monitoring

(匿名高齢者見守りのための参加型生活行動追跡とリスク評価に関する研究)

氏 名 Research DAWADI

(論文内容の要旨)

The advancement in medicine and technology has led to subsequent increase in the life expectancy of elderly people. However, due to their children moving away, and loss of spouse, friends and relatives, most of them are forced to live in isolation. Hospitals, and care homes are crowded, uncomfortable and expensive, while caretakers are expensive and few in number. In this dissertation, we present an anonymous monitoring system through which it is possible to check the completion and duration of various daily basic activities such as medication, shower, and food intake, and analyze them to determine if there is any deviation from usual routine. Similarly, our intention is that our system, a smartphone application, will be used by volunteers and caretakers who can track such deviations and report if any risky situations are detected.

We designed our overall system and developed some technical requirements that had to be fulfilled. First, it is important that the activity details such as completion time and duration are shown in a clear and understandable pattern. We developed an Android based application with features such as candlestick chart visualization, color coding for state of activities and radio buttons for reporting. Second, we do not disclose any personal information of the elderly to the monitor, making our system anonymous. Third, we used two different notification techniques: abN (activity based notification) that is sent every time an activity was completed, and rN (recurring notification) that is sent periodically every two hours, to frequently remind the monitoring person to check the application. And finally, we analyzed if using the application, and reporting about activities regularly will cause a burden to the monitoring person or not.

We used data collected from a real life activity recognition experiment from the houses of the elderly residents in Japan. To evaluate our application, we included some situations where the activity deviated from usual routine based on completion time and duration. Similarly, to compare the effectiveness of our proposed method, we developed two different versions of our application with different activity visualization (using table instead of graph) and notification strategy (using rN only). Through the evaluation study, we found out that about 75.2% of the time, deviations were correctly identified using our proposed method compared to 68.5% & 65.8% of the other two versions. We also analyzed the time taken between opening the activity report of activities, and reporting them. We found that, on average, it took 28 seconds using our proposed method while it took 38 & 54 seconds using the other two versions. The proposed method also provided a better result for the timely reception of reports for activities with a median time value of 115.1 minutes, compared to 118.85 and 121.12 minutes. These results reveal that it is possible to effectively monitor activities of elderly people using a smartphone application, without causing a higher level of burden to the monitors.

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(論文審査結果の要旨)

高齢化に伴い増加している独居高齢者に対し、日常生活を見守り、異常の検知ができるシステムが求められているが、高い導入・運用コスト、カメラ等によるプライバシーの侵害といった問題が存在する。本論文では、これらの問題に対する一つの解決策として、生活行動認識システムとスマートフォンアプリケーションを組み合わせることによって、見守り対象者が誰であるのかを明かすことなく、ボランティアが服薬や入浴、食事など日常の様々な基本動作の完了とその時間を確認し、普段の生活から逸脱していないかどうかを分析・報告することができる見守りシステムを実現した。

本研究の学術的貢献は以下のとおりである。

- (1) 第一に、ボランティアが匿名で高齢者の日常動作の完了をモニタリングし、普段の動作とのずれを発見した場合に報告するという新しいタイプの見守りシステムを提案した。
- (2) Android アプリケーションを開発し、行動の開始・完了時刻の可視化機能と2種類の通知戦略により、行動のモニタリングと異常の検出を簡単、直感的、迅速、かつ負担の少ない方法で行えるように設計した。
- (3) ベースライン方式(通知戦略や可視化機能を持たない方式)と比較して、提案システムが、より高い異常検知率をより少ない負担で実現できることを確認した。

全体として、本論文は、生活行動認識システムとスマートフォンアプリケーションで実現可能な機能を巧みに利用することで、既存システムの問題を解決するこれまでに無い高齢者見守り・異常検知システムを実現しており、本分野において十分な学術的新規性を有していることを確認した。以上より、本論文は、博士(工学)の学位論文として価値あるものと認める。