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| **Source:** | Associação Fraunhofer Portugal Research - Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions |
| **Title:** | Proposal: Multifactorial screening of fall risk in community-dwelling adults |
| **Purpose:** | Discussion |
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| **Abstract:** | This project aims to improve the screening of fall risk in community-dwelling adults. Answers to the “proposal submission questionnaire” (FG-AI4H-B-006) are added as appendix in this revised document version. |

**Project Title**

Multifactorial screening of fall risk in community-dwelling adults

**Overview**

Falls are one of the most common health problems in the elderly population, about a third of community-dwelling adults aged 65 years or older fall each year [1], and these events represent more than 50% of the hospitalizations due to lesions in this age group. Falls are also considered one of the main causes for loss of independence and institutionalization.

Falls have a multifactorial origin [2], however most of the fall risk factors are amendable by implementing falls prevention programs based on improving strength and balance and modifying behaviours. Even though, fall risk screenings and the implementation of such falls prevention programs are rarely part of the community-dwelling elder’s routine.

**Impact**

Falls can lead to minor injuries such as bruises, lacerations, or abrasions, and 10% of cases result in fractures, thus contributing to significant increases in morbidity and mortality. Direct health care costs associated with this phenomenon are high [15], reaching yearly costs of 25 billion euros in the European Union [2] and 31 billion dollars in the United States of America [3].

The current state of the art assessment of fall risk factors is based mainly in applying clinical scales, such as the Morse Fall Scale [4], Berg Balance Scale [5], and Performance Oriented Assessment of Mobility Problems in Elderly Patients [6]. Despite being recommended by international health bodies, such as the National Institute for Health and Care excellence (NICE)[[1]](#footnote-1), multifactorial assessment of fall risk factors is still not widespread in the clinical practice.

One of the reasons for this shortcoming is the difficulty in combining the multiple parameters evaluated in a meaningful scale that is able to differentiate those who are more likely to fall in a period of time following the assessment. Artificial Intelligence (AI) techniques can be of great value in generating models that combine multiple sources of data and enable the implementation and standardization of a multifactorial assessment of the risk of falling.

**Data Availability**

There are no existing open datasets in this scope to the best of our knowledge.

Fraunhofer AICOS, in collaboration with Coimbra Health School and Sensing Future Technologies, has collected a dataset of 537 test subjects, to whom a multifactorial assessment of fall risk factors was applied following the protocol described in [7].

After the assessment, the 403 of the participants received monthly phone calls over a 12-month period to record the rate of falls in this period. The dataset is thus annotated with the rate of reported falls in the period of 12 months following the assessment.

The consortium would be available to open a part of this dataset for training purposes and use the remaining part of undisclosed test data for an evaluation. The dataset division could be made randomly.

The dataset includes, in addition to traditional methods, instrumentation that has been integrated in some standard assessment tests, potentially adding value to the existing methods because it gives additional quantitative information and eliminates the bias introduced by observation [8]. However, since the authors consider that the maturity of this investigation is not yet sufficient to include it in a standard dataset, these data would be removed from the shared dataset.

**Benchmarking**

The participants should submit AI models to combine multiple fall risk factors assessed in community-dwelling adults aged over 50 years old and distinguish the subjects that suffered at least one fall in the year subsequent to the assessment from those who did not fall in that period.

As possible metrics we are currently considering the Sensitivity, Specificity and area under the receiver operating characteristic curve (ROC AUC) applied to a binary classification problem (occurrence of at least one fall in subsequent year vs. non-occurrence of falls in that period).

**Organizer Details**

Associação Fraunhofer Portugal Research is a non-profit research organization with the mission to undertake applied research of direct utility to private and public enterprises and of wide benefit to society. The research center Fraunhofer AICOS conducts applied research and development dedicated to building tomorrow’s information and communication technologies, today. We create cutting-edge innovation based on end-user insights, leading to the deployment of technological solutions that have a positive impact on people's lives.

Fraunhofer AICOS has been performing research in the field of human motion since 2008, more details about our research can be obtained in the website[[2]](#footnote-2). More recently, we have been developing the project FallSensing[[3]](#footnote-3), in the scope of which this dataset collection was planned and executed.

**References**

 [1] World Health Organization. WHO Global Report on Falls Prevention in Older Age. Ageing and life-course 2007.

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[5] Berg K, Wood-Dauphinen S, Williams JI, Gayton D. Measuring balance in the elderly: preliminary development of an instrument. Physiother Canada 1989;41(6):304-311.

[6] Tinetti ME. Performance-oriented assessment of mobility problems in elderly patients. J Am Geriatr Soc 1986 Feb;34(2):119-126. [Medline: 3944402]

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[8] Silva J, Sousa I. Instrumented timed up and go: Fall risk assessment based on inertial wearable sensors. 2016 Presented at: 2016 IEEE International Symposium on Medical Measurements and Applications (MeMeA); 15-18 May 2016; Benevento, Italy. [doi: 10.1109/MeMeA.2016.7533778]

Annex A
Answers to questionnaire [B-006]

1. **Relevance** - How relevant is the health problem to be addressed?

Falls are one of the most common health problems in the elderly population, about a third of community-dwelling adults aged 65 years or older fall each year [1], and these events represent more than 50% of the hospitalizations due to lesions in this age group. Falls are also considered one of the main causes for loss of independence and institutionalization. In 10% of cases falls result in fractures, thus contributing to significant increases in morbidity and mortality. Direct health care costs associated with this phenomenon are high, reaching yearly costs of 25 billion euros in the European Union [2] and 31 billion dollars in the United States of America [3].

1. **Impact** - What level of impact will a benchmark in the context of the proposed project have?

Raise awareness for multifactorial assessment of fall risk factors, contribute to standardize fall risk assessment and create tools to easily implement it in the clinical practice.

Artificial Intelligence (AI) techniques can be of great value in generating models that combine multiple sources of data and enable the implementation and standardization of a multifactorial assessment of the risk of falling. This would enable the creation of a meaningful scale that is able to differentiate those who are more likely to fall in one year after the assessment.

1. **Existing work** - Does the project start from scratch, or are there preliminary experiences?

There is previous work developed under the project FallSensing [www.fallsensing.com](http://www.fallsensing.com) where Fraunhofer AICOS, Coimbra Health School and Sensing Future Technologies, have collected a dataset of 537 test subjects, to whom a multifactorial assessment of fall risk factors was applied following the [protocol](https://www.researchprotocols.org/2018/8/e10304/) described in [7].

After the assessment, the 403 of the participants received monthly phone calls over a 12-month period to record the rate of falls in this period. The dataset is thus annotated with the rate of reported falls in the period of 12 months following the assessment.

The screening includes questions about demographic and anthropometric data, health and lifestyle behaviours, a detailed explanation about procedures to accomplish 6 functional tests (grip strength, Timed Up and Go, 30 seconds sit to stand, step test, 4-Stage Balance test “modified,” and 10-meter walking speed), 3 questionnaires concerning environmental home hazards, and an activity and participation profile related to mobility and self-efficacy for exercise.

1. **Feasibility** - Is the project feasible, based on the current state of the art?

Preliminary data analysis shows promising results.

1. **Data Availability** - Is there sufficient data available? How much of it can be openly available? How much of it as part of the non-disclosed data set?

There are 403 data samples annotated. All of the data is currently a non-disclosed data set. A small part of it can be openly available (1 ou 2%).

However since the data acquisition [protocol](https://www.researchprotocols.org/2018/8/e10304/) is published in an open access journal, it can be easily replicated by peers.

1. **Data Quality** - Is the available data of high quality?

Data was acquired by health professionals trained to the effect in a prospective longitudinal study, following a convenience sampling method. Data was collected solely on the Portuguese population.

1. **Annotation / Label Quality** - Are the annotations / labels of the data of high quality?

The health professionals called each participate every month for one year after the assessment in order to record the rate of falls. This procedure follows similar studies in the literature.

1. **Data Provenance** - Has the data been obtained in a professional and ethically correct way?

Ethical approval was obtained from the Research Ethics Committee of Polytechnic Institute of Coimbra (Nº6/2017). All participants gave written informed consent before data collection begins as per the Declaration of Helsinki.

1. **Benchmarking** - Do the applicants have a clear proposal about what exactly should be evaluated / measured?

There is a proposal, however it can be further discussed.

1. **Organizers** - Can the Focus Group work with the applicants, and do they have the time / resources to work with the Focus Group on the problem?

If the time needed is significant, the applicants can allocate the needed resources upon availability of funding.

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1. <https://www.nice.org.uk/guidance/cg161/chapter/recommendations#multifactorial-assessment-or-multifactorial-falls-risk-assessment> [↑](#footnote-ref-1)
2. <https://www.fraunhofer.pt/en/fraunhofer_aicos/our_work/portfolio/Motion.html> [↑](#footnote-ref-2)
3. <http://fallsensing.com/> [↑](#footnote-ref-3)