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Introducing a pilot data collection model for real-time evaluation of data redundancy

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Abstract

In order to reduce serious health incidents, individuals with high risks need to be identified as early as possible so that effective intervention and preventive care can be provided. This requires regular and efficient assessments of risk within communities that are the first point of contacts for individuals.

Clinical Decision Support Systems CDSSs have been developed to help with the task of risk assessment, however such systems and their underpinning classification models are tailored towards those with clinical expertise. Communities where regular risk assessments are required lack such expertise. This paper presents the continuation of GRiST research team efforts to disseminate clinical expertise to communities. Based on our earlier published findings, this paper introduces the framework and skeleton for a data collection and risk classification model that evaluates data redundancy in real-time, detects the risk-informative data and guides the risk assessors towards collecting those data. By doing so, it enables non-experts within the communities to conduct reliable Mental Health risk triage.

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1. Introduction

Effective risk assessment is vital for enhancing health care delivery and ultimately patient outcomes particularly in the mental health sector¹. Various studies show that failure to detect health problems in the early stages of development results in higher mental-health risks including suicide². On the other hand, early detection and effective preventive measures in psychosis services have high impacts in reducing the probability of mental health risks and the risk of suicide in particular^{3,4}.

The problem is that risk assessment and the prediction of the level of risk while clearly extremely important, is difficult⁴ and a major clinical challenge⁵ and requires clinical expertise. This is for various reasons including the

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complexity of factors influencing the level of risk, rarity of the serious incidents^{6,7} fuzzy nature of many health symptoms and risks, missing data,^{8,9} and the time that is needed for accurate risk assessments^{10,11}.

In addition to the general difficulties of risk prediction, effective risk assessments are those with which individuals at high risk are identified and monitored as early as possible so that preventive measures are provided in time. In other words, the risk assessments' objective should be to predict, not just for example who successfully will commit suicide, but who is likely to try and attempt suicide. The focus should be to stop any attempt and this is only possible if potentially high risk individuals are identified early enough and hence referred to specialist for detailed monitoring and assessment. This means that risk assessment needs to be conducted on a community level that is the first point of contact for most people¹². Community level include social workers, 111 paramedics and other front line services which do not have specialist clinical expertise but are faced with patients on daily basis.

To enable risk assessment to be carried out on a community level, the clinical expertise necessary for risk assessment and prediction need to be made available to non-experts. This is the aim of this research paper: Building on top of our initial research started in 2014 and reflected in a previous paper¹³ this paper aims to shed further lights towards enabling non-experts to use expertise extracted from clinicians to conduct fast but reliable risk triage. It does that by introducing and testing the initial skeleton of a risk triage data collection and risk classification model. Thus the objective is to probe the appropriateness of our previous research as indicated in our previous paper¹³ and taking the first step towards an ultimate data collection and risk classification model. The final model is aimed to guide non-experts risk assessors through huge pools of possible data to collect only those data that are relevant and informative for the purpose of quick safe triage that is specific to the particular patient under assessment.

We first describe the context including the Clinical Decision Support System based on which our research was conducted as well as the former findings which form the conceptual framework for this paper. After that comes the methodology followed by introducing our initial data collection and risk classification model and evaluating its performance. The paper ends with describing the future work.

2. Context and the Conceptual Framework

Clinicians need to be able to carry out varied level of risk assessments based on patients circumstances and context. In each case, they require a different set of data to be collected in a different way with perhaps different order of collection or importance. This implies that clinicians are faced with so much data from different sources, different patients and different contexts with ever evolving information¹⁴ and their judgement may even then be affected by factors beyond the patients presentation (i.e. the data collected)¹⁵.

To aid clinicians with the task of risk assessment, Clinical Decision Support Systems CDSSs have been developed to incorporate research and evidence-based approaches and techniques into daily practice and hence aid clinicians in their clinical work and in particularly clinical decision making^{16,17,18}.

Galetean Risk & Safety Tool GRiST is a mental health Clinical Decision Support System that aims to assist the early detection of multiple risks, including suicide, self-harm, harm to others, self-neglect, and vulnerability amongst people with mental health problems¹⁹. It is built using a psychological model of human expertise that attempts to approach risk assessment in the way clinicians do. It aims to combine human expertise together with actuarial tools to help mental health clinicians in their daily risk assessment tasks. GRiST is used by various sectors including NHS secondary Mental Health Trusts, charities as well as IAPT services. In the future it will also be available for use in other front line agencies such as the criminal justice system, housing associations, accident and emergency departments.

This paper presents part of an effort by the GRiST research team to disseminate clinical expertise to the wider community by working towards a critical risk screening version of GRiST to be used by non-experts risk assessors on daily basis for fast risk triage.

GRiST has been developed based on a specific psychological model of classification in which clinical expertise is represented in a way whereby risk nodes such as suicide are hierarchical trees that are deconstructed into progressively more granular concepts (branches) such as current intention and feelings/emotions until the input data nodes or leaves of the tree (e.g. anger) are reached. Figure 1 shows a simplified portion of the suicide knowledge hierarchy.

While GRiST has several hundred leaf nodes, and therefore a very large potential data set for each patient (137 data features only for risk of suicide), the actual number of questions that is applicable to individual patients is much

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