Project description for Forte 2020 application

Not in this document:

* Basic information
* Ethics
* Relevance
* Budget
* Administrating organisation
* Review panels
* Participating researchers
* CV
* Publications

(See Instructions – <https://forte.se/app/uploads/sites/2/2019/12/implementation-research-2020-instructions-for-the-application-form-ta.pdf>)

Level 1 headings: provided by Forte/PRISMA. Level 2 headings are mine

# Purpose, research questions, theories, background and the originality of the project (max 20 000 characters)

## Purpose

To understand the utility, opportunities, and obstacles in implementing an automatic image analysis tool for delineating lesions on magnetic resonance (MR) images of the human brain. There is a plethora of literature articles describing relevant algorithms, but most documented implementation efforts pertain to a single niche application, radiation therapy planning (perhaps also disease burden estimation in multiple sclerosis?). Most articles claim that the algorithms they describe have clinical potential, but the critical path towards sensible workflow modifications in the routine practice of image interpretation is underexplored.

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## Research questions

* In the routine of reading MR images, what are the pain points felt by practitioners (radiologists, neurologists, and neurosurgeons)?
* What improvements would practitioners expect/desire from a tool based on an automatic lesion delineation algorithm?
* What workflow modifications would be desired/required/tolerated in the implementation of the tool?
* What are the necessary characteristics of a tool that practitioners could use to improve the image analysis workflow?
* What are the desired elements and characteristics of a tool that makes automatic brain lesion delineation results accessible to practitioners?
* What form of interaction between tool developers and practitioners would favour the development of a tool that practitioners would embrace?
* What is the prevalent focus of developers when designing and testing/validating an algorithm?
* What gaps does this leave open with regard to clinical implementation?
* Which of these gaps are par for the course / unavoidable?
* Which gaps could be addressed by adhering to reporting standards/recommendations?

%%% Thoughts? Additional groups? Overlap may be unavoidable, perhaps beneficial? Ask many questions or condense?

## Theories

Participatory design

%%% Katka, Birgit

## Background

The impetus for this project developed during the analysis of a scoping review we carried out on the subject of automatic brain lesion segmentation from MR images (cite BMJ open). A striking feature of the literature landscape is that there is an abundance of methods, but the validation is often restricted in ways that do not support clinical implementation. For example, a typical validation strategy is to apply the method to contest data, i.e. collections of brain images with lesions that have been manually delineated, with the manual delineation serving as the criterion standard. This kind of challenge bears little resemblance to any clinical situation: to begin with, a clinical image may not contain a lesion at all. Most articles do not report on the behaviour of an algorithm in the absence of a lesion… A common claim is that the algorithms described have clinical potential, but few authors elaborate on the meaning of this statement or propose/announce future research to explore and manifest this potential… the critical path towards sensible workflow modifications in the routine practice of image interpretation is underexplored…

from meeting notes (thanks Katka): “we have done this research; we found this, we discovered it matches the exact problem we find frequently in science; we draw on implementation research to find solutions to the problem”

%%% Katka: implementation research

%%% Katka: participatory design

%%% Rolf, Emilia: image analysis (mainly new, using some text from scoping review)

%%% Isabella: clinical challenges answered with brain imaging; role of lesions

%%% Others?

%%% Side note – Emilia: did any of your sample authors discuss absence of lesions as an algorithm output?

## Originality

Relationship with “Professional trust and autonomous systems”

%%% Rolf, Emilia

# Keywords

1-5 keywords

Emilia: frequent MeSH items from scoping review sample? two to three

Plus two to three pertaining to the domain and research approach

# Study design, methods for data collection and analysis (max 15 000 characters)

%%% To be discussed

# Interdisciplinary and/or multidisciplinary approach (max 2 500 characters)

A team composed of experts from education, imaging scientists/engineers, and clinical practitioners, in a unique position to tackle the challenges of the project …

# Gender and diversity perspectives in the content of the research (max 2 500 characters)

Brain imaging is applied in a broad variety of diseases that, taken together, affect all genders, races, and social circles. Research results will be approximately equally relevant across gender, ethnic, and socioeconomic groups represented in Sweden.

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# Work plan (max 15 000 characters)

Package structure, Gantt chart …

At the reporting stage, we will seek to follow StaRI guidelines and checklist (27 items) to the extent that they are transferrable from the original target domain (public health) to our domain. [https://www.bmj.com/content/356/bmj.i6795](Pinnock%20et%20al.,%20BMJ%202017)

# References for the project description (max 7 000 characters)

# Gender distribution of the project group (max 500 characters)

The project group has a balanced gender distribution.

# Image uploader

Gantt chart

%%% Pasting Katka’s meeting notes. Processed some of it (green), some is perhaps not relevant any more (gray), some bits are important and unprocessed (red)

* What kind of a tool is beneficial to the radiologist?
* Who should be involved? In the application
  + Birgit: more towards the design, swiss , postdoc in GPCC: documentation
  + many conceptual frameworks to choose from;
* standalone project vs in relation to the AI trust application ?
* just a little about AI; fully about segmentation
* jonas could be in favour of applying, put in a support letter, not a coapplicant
* sound distinction content wise to the AI trust project

**How do we approach the writing?**

* we dont have a previous application to base it on.
* overlap between the paper and the application: small => we need to write a lot from the scratch;

**What is the gap?**

* the way the methods are validated - is it enough?
* methods are not used, because they are not validated for a specific task;
* obvious path: the story of the literature review;

we find that: in the analyzed papers: a lots of ideas for algor. and such; but in comparison there is little efforts that is usable and used in practice;

* implementation research:
  + findings - are they generazilible?
  + we have done this research; we found this, we discovered it matches the exact problem we find frequently science; we draw on implementation research to find solutions to the problem
  + much of the research efforts do not lead to anything at the end;
  + from the perspective of the radiologist;

another option =>

* the perspective of an algorit design researcher: she has a great way to validate a method, to publish the results (conference/journal), at the very far end, is creating benefits for patients or radiologist, the only measurable content - do you make money out of it? the only way how to validate patent;
* there are gaps between these three stations: how do you know that you are on the right track? There are no intermediate outcomes; one possible outcome is a checklist; did you report conditions that will allow it to make it useful.
* how science is organized in terms of publications;
* But this is a more political idea; might be difficult to handle in this application

another idea:

* ask money for prototype appliance;
* method; there are ca 2000 papers out there on this topic;
* major outcome: valley of death; between proof of concept and its application in the real world;
* take an existing algorithm and modify it, put it into a box (computer unit), to try this out in an existing pac network; => what obstacles there will be? on the way to getting the functionality of the appliance in front of the radiologist;
* ask for hardwear money
* part of the FORTE call; constitutes a line of query;

**Participatory design take**

* how and when do we involve the radiologist in the process - algor and method design

matter for the experts to develop the algoritms - by jobs;

* what do the radiologist need to know?
* how in current practice are users being involved in the development of brain-lesion segmentation algorithm?

the starting point from which we want to explore the problem:

* Are radiologist being actively involved in the actual design of the tools or methods? what evidence is there? is our impression true or not true?
* What opportunities exist for developers to get more usable results?
* What challenges of the involvement of the radiologist into the design process are there? When and how they should be involved?

**Next steps**

* by Wednesday night Rolf will send out the draft to us, then we can divide the tasks; but also to share it with isabella and jonas.
* we will need SNICK resources; they are the best - Emilia will look into it
* STAR guideline (*here I didnt catch the exact name)*; checklist reporting for an implementation research; (public health)
* access the grant office - emilia is working on it