Visual Storytelling for Informed Decision-Making in Medicine

L. Amabili[1]   F.H.J. van Hoesel[4]   T. Klaver[3]   J. Kosinka[1]   M.A.J. van Meersbergen[3]
A. Mendrik[3]   P.M.A. van Ooijen[2]   J.B.T.M. Roerdink[1,2]   P. Svetachov[4]   L. Yu[1]

[1] JBI, University of Groningen   [2] University Medical Center Groningen
[3] Netherlands eScience Center   [4] Center for Information Technology, RUG

Introduction

In healthcare, **big complex imaging data** are processed and analyzed regularly. Afterwards, the findings are communicated to inform educated decisions. In this procedure, **human errors** or misunderstandings can occur, especially when more than one person is involved, or due to the use of text reports, thus lengthening the time devoted to each case. For this reason, a more effective way for communicating and presenting findings is required.

In our project, we focus on answering the following research questions:

- *How to communicate results effectively to enhance **collaborative work**.*
- *How to **reproduce findings** in decision-making circumstances.*
- *How to **substitute text reports** without loss of information.*

To this end, we aim to develop an IT tool based on the principle of visual storytelling which will let users present data clearly and facilitate collaboration with experts in different fields, and medicine in particular. As a consequence, we expect that this novel approach will improve the overall diagnostic process.

A New Approach to Analyzing Medical Data

The main innovative aspect of this project is the use of **visual storytelling** in the decision-making process. In addition, **provenance data** are recorded during data exploration and showed in an interactive graph which allows the user(s) to navigate the analysis process, extending the study or authoring it with annotations, measurements or statistics (see Figure 1). This procedure can be repeated and adjusted as many times as needed, even after having presented the results [1].
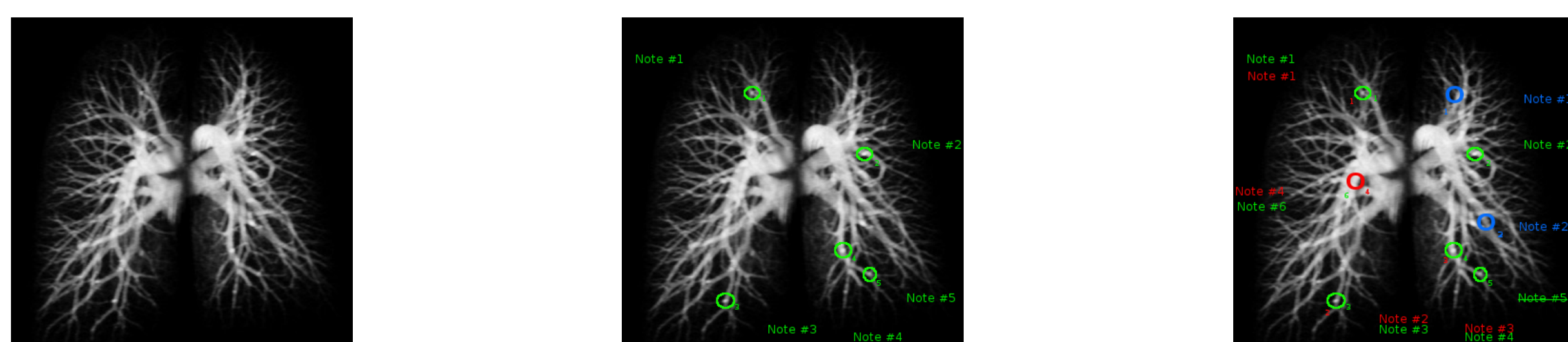

Figure 1: *A short visual story composed by the medical input data (left), a frame from one-user analysis (center) and a frame from multiple-user analysis (right).*
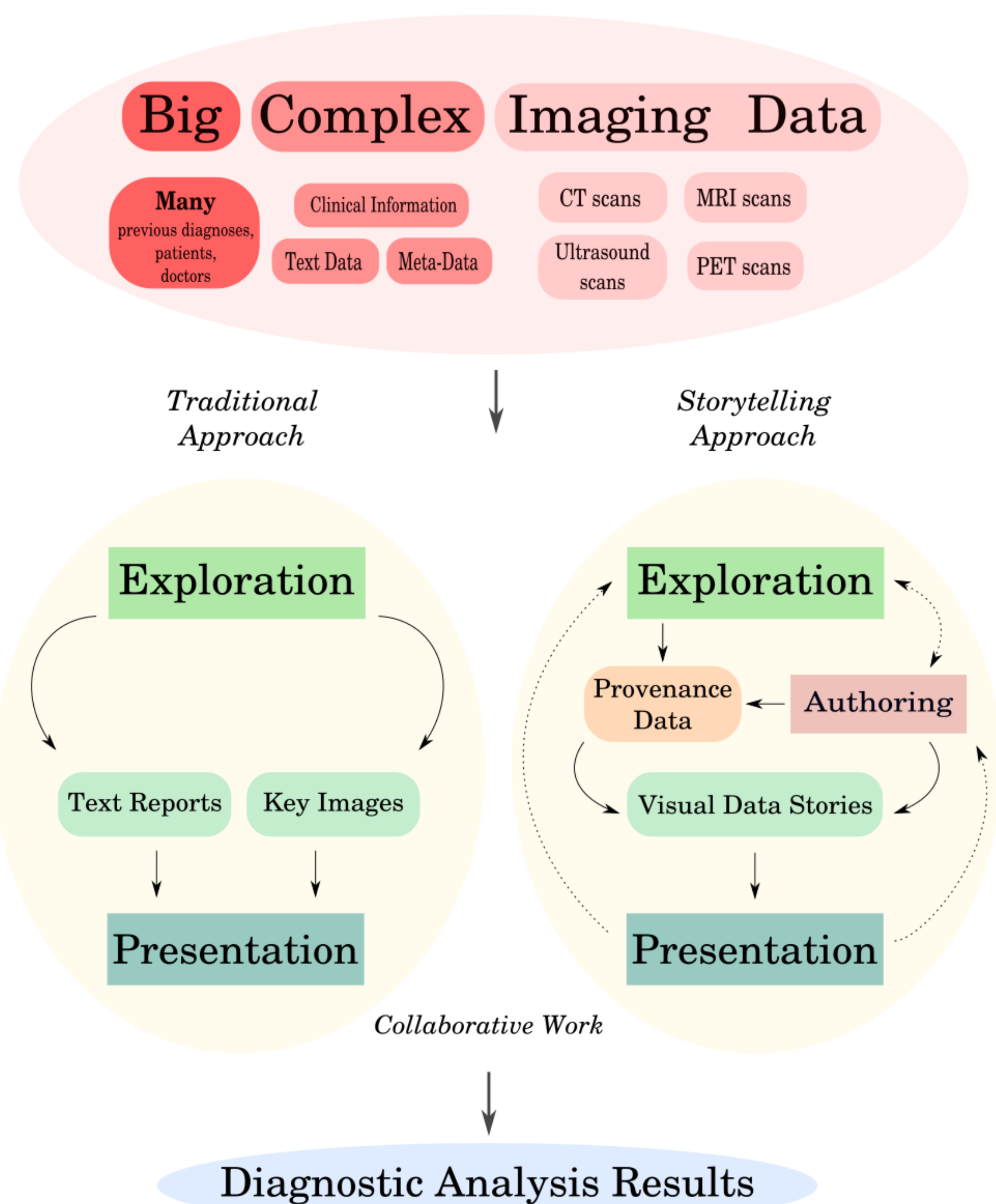

Figure 2: *The diagnosis process in healthcare based on the traditional workflow and the (visual) storytelling approach, which consists of a three-stage non-linear process (i.e.,* Exploration*,* Authoring*,* Presentation*).*

According to our vision, a (visual) storytelling approach can be expected to successfully achieve the substitution of text reports with visual data stories which are more informative and less ambivalent, thus reducing human errors, improving collaborative work and increasing diagnosis understanding in a broader audience (see Figure 2).

A Visual Storytelling Tool to Support Medical Decision Making

Our project is aimed at improving medical data analysis via enhancing collaborative work and making the communication of results more effective by using a visual storytelling tool. Composed of an intuitive interface to explore complex imaging data and an authoring tool to create visual data stories based on provenance data to present findings, it provides users with increased flexibility [2]. We envision that this text-free approach will refine and facilitate the current medical work-flow, by decreasing the risks of misunderstanding, reducing the time needed for each analysis, and simplifying collaborations among both experts and non-experts. Furthermore, the reproducibility of analysis will boost transparency of the decision-making process [3].
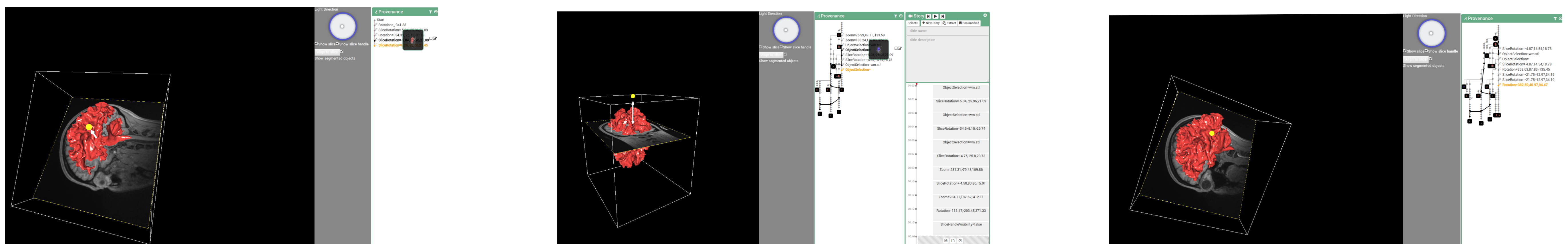

Figure 3: *An example of an imaging data analysis made by using a prototype built upon the Phovea framework by the Caleydo team [1] (left). After exploration of brain image data, a visual data story is created (center). Then, the results can be reproduced and the data exploration can be extended (right).*

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Contacts

Prof. Dr. Jos B. T. M. Roerdink, chair JBI, Institute for Mathematics and Computing Science University of Groningen Nijenborgh 9 9747 AG Groningen

MSc Lorenzo Amabili, PhD Student JBI, Institute for Mathematics and Computing Science University of Groningen Nijenborgh 9 9747 AG Groningen

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