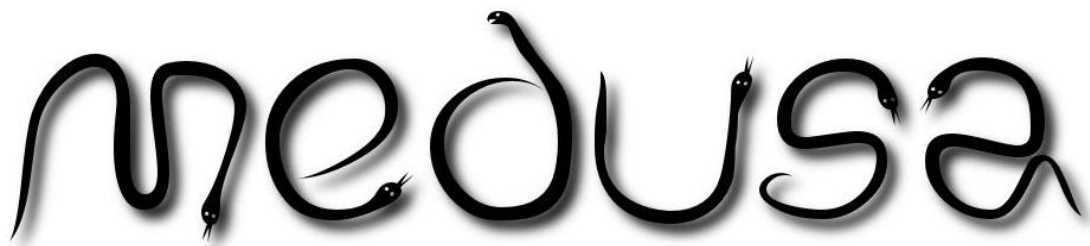


MEDUSA

DELIVERABLE

D122 Demonstration report & Clinical validation

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Medical Distributed Utilization of Services & Applications

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1 Introduction

1.1 Aim of activity

This document provides the report of the user experiences of the demonstrators (See D121 Demonstrator plan). The experience of the user is reported per demonstration. The demonstrations and discussions with the clinical experts are recorded for most demonstrations. In this document we briefly report what the clinical expert **liked** from the Medusa system and what they **recommend** to implement. We also report what we have **learned** from the clinical experts.

1.2 Overview of Medusa demonstrators

Acute scenario: Ischemic Stroke demonstration
Acute scenario: Trauma demonstration
Post traumatic Coma demonstration
Contouring for oncology demonstration
Computer assisted in vitro diagnostics demonstration
Collaborative decision support for oncology demonstration

2 Acute scenario: Ischemic Stroke demonstration

Demonstration date: 10-11-2015

Location: Academic Medical Center Amsterdam

Clinical experts present: a Neuroradiologist and an Emergency radiologist

The demonstration and discussion with the clinical experts is recorded (see Google drive, see reference section for the movies)

Likes

Fast time to treatment leads to better outcome for patients with a stroke. The Medusa system saves valuable time in the diagnosis of stroke since part of the investigation can now be performed in the ambulance.

Using the Medusa system a decision can be made to which hospital a patient should be transported. This saves a lot of time because the patient goes directly to the hospital that can provide the level of care this patient needs and does not have to be transferred to another hospital if the initial hospital cannot provide the needed level of care.

It is very valuable that the vital signs can be streamed from the ambulance to the hospital. This allows the doctors to inspect for example the blood pressure and give instructions to the paramedic if needed.

The interactive medical image viewer allows a direct second opinion or expert opinion in the acute situation.

Recommendations

Add a map with the location of the ambulance and the estimated arrival time. The care team in the hospital can see exactly where the ambulance is and how much time they have to prepare before the patient arrives.

Add an easy form to score the stroke severity using The National Institutes of Health Stroke Scale (NIHSS) or the The Los Angeles Motor Scale

(LAMS) scoring systems. Based on the score on these scales and the professional opinion of the medical doctor in the hospital patients can be triaged in the ambulance. Patients with a severe stroke can be directly transported to a specialised intervention centre. This saves valuable time since these patient do not need to be transferred.

Add Medusa in the intervention room and operating room. This allows direct collaboration with remote colleagues during the medical procedure.

The video conferencing can also be used to record the conversation between the patient and the medical doctor. The patient can view the conversation later in case important information was forgotten. It is difficult for patients to remember information of such a conversation especially if they received some bad news.

It would be valuable if future Electronic Patient records can be integrated into Medusa.

Learning points

Post processing of the medical images is nice but is less important in acute situation. It is more than sufficient that medical doctors can view the medical images regardless of their location. It is important that there is no latency in the interaction with the image viewer. Fast and reliable internet connection is important

Patient privacy is very important and the cloud should be secure.

3 Acute scenario: Trauma demonstration

Demonstration date: 14-10-2015 and 20-11-2015 (and 26-10-2015)

Location: Academic Medical Center Amsterdam (Hôpital Pitié Salpêtrière in Paris)
Clinical experts present: Trauma surgeons (Trauma radiologists)

The demonstration and discussion with the clinical experts on 14-10-2015 has been recorded (see Google drive, see reference section for the movies)

Likes

The experts are enthusiastic about the continuous stream of vital sign data that is captured starting in the ambulance and shared in real-time with medical doctors in one or more hospitals. Currently vital sign information from the ambulance is piecemeal and does not allow to identify trends. As vital sign information is crucial to diagnosis, the experts expect that the immediate and continuous availability of vital sign data will help significantly reduce under triage and over triage. From all major trauma patients, 20% currently ends up in a local hospital whereas they should have been taken to a level 1 trauma centre. A higher accuracy in triage benefits the patient and the hospital (efficient use of resources).

The alerts generated by the decision support application will help the trauma team to keep track of changes in the patient's condition, esp. to detect dangerous combinations of factors that require immediate action. It is also well-received that decision support rules can be defined by the medical doctors in the context of a medical protocol, and that the parameters and values used in the rules are configurable. By defining medical protocols for specific groups of patients, the decision support allows to standardise and finetune the trauma care provided.

Recommendations

As the MEDUSA services require an internet connection and internet coverage may be low or absent in parts of the country, it should be possible to capture and display vital sign data and run decision support on a local network in the ambulance.

The vital signs application and decision support application will also be very useful for monitoring patients with a chronic disease, a development that hospitals are preparing for.

Both hospitals think that ambulance services will be very interested in the applications of this demonstrator and strongly recommend to involve ambulance services in follow-up discussions on further development and implementation.

The applications in the Trauma demonstrator are also relevant for other emergency cases: cardiac and stroke.

Learning points

In France the ambulance staff may include a medical doctor (not just paramedics), but there also it is considered useful to be able to collaborate in real-time with colleagues elsewhere. The vital signs display showing trends and the alerts generated by decision support continue to be important.

Continuously capture and display a vital sign like Respiratory Rate is an innovation in itself as this information is lacking nowadays.

The demonstrator tends to slow down or cannot be fully used when accessed on a tablet or other mobile device.

4 Post traumatic Coma demonstration

Demonstration date: October 26, 2015

Location: Paris, La Pitié Salpêtrière Hospital, Radiology Service

Clinical experts present: Prof. Ph. Grenier, Prof. D. Dormont, Prof. O. Lucidarme

Technical staff: Rahul Gaurav, R&D engineer

The demonstration and discussion with the clinical experts could not be recorded; however, a functional demo was filmed during the Best MEDUSA workshop and available under the conditions specified by the MEDUSA consortium. (see Google drive, see reference section for the movies)

Likes

- the usage of the virtualized application does not require from the clinical expert any technical insight related to the cloud
- the information required in medical decision making is not downgraded during the cloud portability process
- all the functionalities available in the local set-up are preserved in cloud deployment
- the possibility of using the application from a mobile terminal
- the collaboration functionality which was added by MEDUSA
- the collaboration between two mobile terminals was fluid
- the possibility of using unitary identification
- the possibility of displaying personalized content

Recommendations

- prepare an awareness discourse for popularizing the application virtualization inside the medical community

Learning point

- the fact that the cloud distribution implicitly preserves and reinforces the intellectual property & rights related to the application is very valuable for medical applications; this should be clearly explained to the medical community

More details are available in D132 – *Validation of MEDUSA and final impact assessment on healthcare.*

5 Contouring for oncology demonstration

Demonstration date: 12/11/2015

Location: Gustave Roussy Hospital

Clinical experts present: Radiotherapist, Nuclear Medicine Physician

Likes

- The concept to access to the application and to patient's data from anywhere and not only from the interpretation room;
- The concept to access to the MEDUSA framework using only a web browser;
- The capability for many users to interact in real time using the contouring tools.

Recommendations

In order to push MEDUSA framework to the routine, an effort is expected to improve the fluidity of image display. Especially, the MIP 3D view is not really usable within the MEDUSA framework when it is needful in nuclear medicine for tumor localization.

Learning point

Contouring task for oncology is the most tedious task in order to prepare a treatment plan for radiotherapy. Many contouring applications have been developed for that purpose. The manufacturers always tried to facilitate this task by providing useful methods and ergonomic tools dedicated to fast and effective contouring. Medusa will take over standard standalone applications if its workflow does not complicate or slow the way users work.

6 Computer assisted in vitro diagnostics demonstration

Demonstration date: 25/11/15

Location: Imstar, Paris

Clinical experts present: Michel Soussaline, MD

Likes

Expert appreciated the digital image quality, considering it the key argument for the replacement of the microscope use by the computer-based imaging. The interface of the virtual slide module is considered easy, intuitive and sufficiently responsive for everyday diagnostic work. Facility of the access to the slide archive in the digital form is a very positive point.

The quality of the automated processing is good; the cell segmentation and classification procedures miss virtually none of the abnormal cells. However, certain amount of the false positives (not abnormal cells pre-classified as possibly abnormal cells) is present after the automated processing.

The procedure of review and validation of the pre-selected cells, presenting them one by one and requiring the expert to either validate or reject them, is clear, easy to use and sufficiently responsive. Possibility to perform the review and validation process by multiple users at different locations at the same time is very much appreciated, as it simplifies the knowledge sharing and transfer.

Additional plus is the traceability of the review, validation and the diagnostic process; as the system actually records the user choice concerning every cell, it is easy to return to the diagnostic data later if needed.

Recommendations

The login procedure includes some repetitive steps (configuring the application list), it would be nice to store the configuration for every user.

Image data transfer from the microscope workstation to the storage used by the platform could be simplified.

Learning points.

Virtualisation of the microscope slides can enhance the international scientific/educational collaboration.

A deeper integration between the microscope workstation and the Medusa storage would be the next important thing to do

7 Collaborative decision support for oncology demonstration

Demonstration date: 27/10/2015

Location: Pitié Salpêtrière Hospital, Paris

Clinical experts present: Prof. Philippe Grenier, Prof. Olivier Lucidarme

The demonstration made to the clinical experts is recorded (see Google drive, see reference section for the movies)

Likes

- The concept of lossy-to-lossless progressive quality access of the remote DICOM images which allows clinical diagnosis to start before the end of data exchange.
- There is total transparency for the clinical staff of the on-going data transfer. The clinical staff can concentrate on his diagnosis task.
- Knowledge of the image quality level: any image investigated has the quality level displayed as a color code. Even if visually the quality seems unaltered, the clinician can see if he is not looking at lossless quality data and can immediately request that level. This guarantees that wrong medical decisions cannot be due to the image quality.

Recommendations

In order to exploit this data exchange concept more largely and expand it to interconnecting small/private clinical settings, a mechanism requiring the remote DICOM data compression to JPEG2000 at the distant setting, prior to download it as progressive quality at the local setting, should be implemented.

Learning point

The achievements of MEDUSA in terms of on-line remote image exchange during collaborative meetings have shown an alternative to the deployment of national PACS systems by allowing considering a decentralised storage of patient data, directly in the hospital centres where it is produced. This could indirectly impact the national healthcare policy in terms of patient data management and consequently the market related to the associated products (namely the PACS solutions). Post traumatic Coma demonstration

Demonstration date:

Location:

Clinical experts present:

8 Summary

Based on the clinical demonstrations of Medusa the clinical experts are very enthusiastic about Medusa. They feel the proposed functionality and techniques of Medusa can solve a lot of their problems and improves health care by speeding up the process of diagnosis and improved collaboration between medical experts. Concluding the clinical experts see a lot of potential in Medusa and think it has a lot of added value in current health care.

9 References

Reference	Document ID	Title
D111	V3.0	Use case scenarios and User requirements
D121		Demonstrator plan
D132		Validation of MEDUSA and final impact assessment on healthcare

Reference to Google drive location with videos:

https://drive.google.com/a/technolution.nl/folderview?id=0B2uEAjQrV40ITDZPdHg5ZHpCWFk&usp=sharing_eid&ts=565870ed