# VIP : système de visualisation de données patient

VIP: A Patient Health Records Visualization System

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Résumé – VIP est un système de visualisation de données patient développé pour deux cas d'usage : la consultation, et les réunions de comité, où les médecins discutent de chaque cas pour décider de la suite des traitements à donner. Il offre un accès complet à un cas patient, ainsi qu'une représentation graphique interactive de son historique, permettant, même sur des dossiers comprenant des centaines de rapports médicaux, de produire une représentation synthétique du dossier, que les médecins utilisent pour acquérir visuellement la situation du patient. Nous présentons le cas d'usage, les contraintes et les choix de représentation réalisés pour la mise en œuvre effective de ce système.
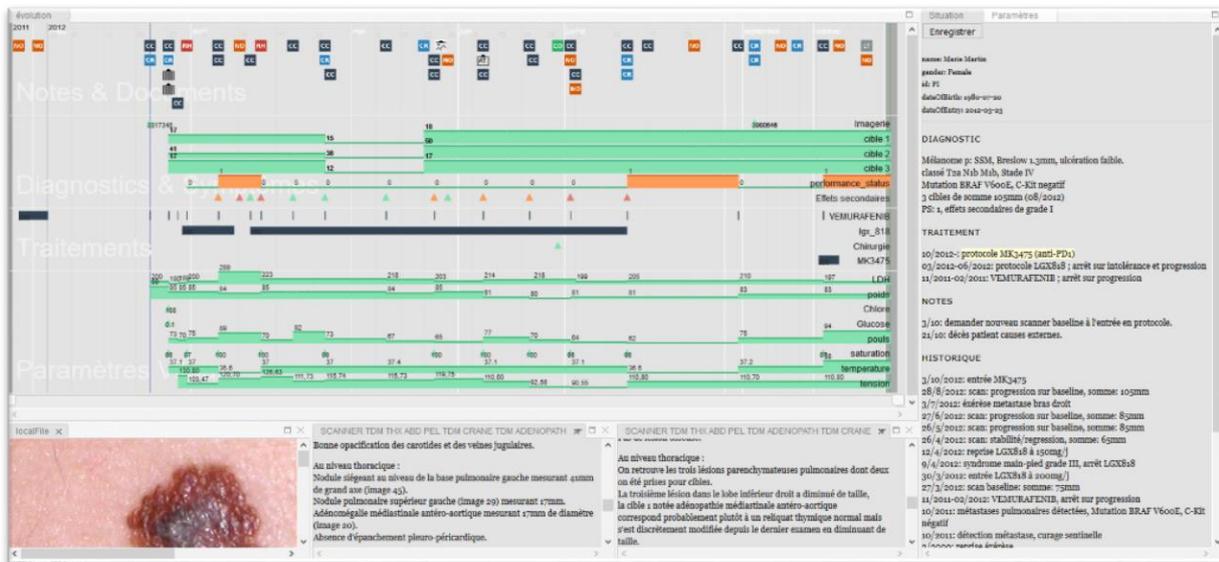
INTRODUCTION

VIP is a patient health record visualization system inspired from a former collaboration with a large hospital. A Cancer treatment service had expressed the need to get overviews and summarizations of their patient cases, which often contain hundreds of documents: images, analysis results and reports of various kinds for each patient. Upon being presented with the potential of patient health visualization systems [1], stakeholders at the hospital agreed that a visualization system such as LifeLines [2] would indeed be the best mean of acquiring rapidly an overview of a patient case.

1   USE CASES

We envision 2 distinct use cases in which VIP would be useful: first, in a consultation setup, when a doctor needs to rememorize a patient case and get fast access to past documents. The second use case is the weekly committee review, when all patient cases, sometimes close to 50-100, are examined and discussed collectively. In this situation, the doctor in charge of the patient presents the current situation to the team, which includes other specialists, such as radiologists, biologists… Those know much less about the patient, and are asked to provide their opinion on the current situation and proposed treatment. They can, on request, access all reports and imagery from the application. As there are many patients examined in a single afternoon session, the visual summary appeared much more helpful than the current textual displays used in those meetings. Finally, VIP itself relies solely on a set of time-stamped documents from which indicators can be extracted. Many more uses cases can be considered.

2   PATIENT DATA

Patient data is extracted from a database and contains a variety of elements: all consultation reports, reports on the various exams and treatments the patient has received, the available imagery, as well as biological results stored as database records. The quantity and quality of information available for each patient is extremely variable: some patients arrive at a late stage in their treatment, and only some data is available as pdf files. Patients who follow a protocol have much more data, up to 600 report files and thousands of exam results and images. The patient cases have spans which range between a few months and 2 or 3 decades, which means that our visualization choices must be robust enough to handle the large variability of patient cases.

3   EXTRACTING INDICATORS

Most of the useful data is stored in the consultation reports, which are stored as text files: treatments received, side effects observed, progression of the symptoms… The vocabulary used in those reports is somewhat stereotyped, but is not fully consistent. Nonetheless, we can retrieve a large portion of the useful indicators through relatively simple pattern matching: for treatments, for instance, the molecules used have quite distinctive names, such as "VEMURAFENIB", which are known and stored in the database.

This has provided us with a means to organize the main display quite simply, in 4 groups: 1- available documents, 2- diagnostics and symptoms: diagnostics, targets, side effects, 3- treatments: radio and chemotherapies, injections, molecules taken and surgeries, and 4- vitals, exam results extracted from the database. Each group can be customized to display indicators relevant to the case at hand.

4   NAVIGATION

The central pane is meant as a visual first aid, but doctors absolutely need detailed access to the patient files. When hovering over an indicator, a tooltip displays the sentence context from which the indicator has been extracted. This allows, for instance, displaying the observed side effects and treatments as a single line on the main display. Clicking on an item opens a tab with the full document in a multi-window pane implemented with GoldenLayout [3]. Document panes can be rearranged at will for easy comparison of documents. Finally, a summary pane, on the right side, displays a text summarization of the last version of each section found in a report. This provides easy access to the latest updated version of the patient case. This "Situation" pane could be annotated and versioned by doctors to maintain an accurate status of the case. However, legal constraints preclude providing this much wanted functionality.

5   VISUAL ENCODINGS

Indicators are displayed according to their type:
- documents with a relevant icon
- "instant" indicators display an instantaneous act or observation, such as a surgery, a therapy session… they are displayed as a triangle, colored according to its relative importance/severity (green, yellow, orange, red…)
- "transient" indicators display events that have a duration, such as a treatment or a hospitalization. They are displayed as rectangles whose color and relative height can be used to encode various parameters such as effectiveness or dose.

- "permanent" indicators, such as vital signs or biological variables are displayed as bar charts, using also height and color to indicate values, with a variable degree of transparency to reflect the uncertainty of the parameter's actual value.

6   TEMPORAL SCALE

As we said, a patient case can easily span decades. Of course, during such long spans, the intensity of care and available documents varies, which is why the temporal scale is adjusted according to the local density found in each given time span. This still conveys the important periods of a patient case, and yet allows the display to stay information-dense. A range slider enables both translation and zooming in one integrated widget, as implemented in the Discovery visualization system [4]. The algorithm used for time dilatation is inspired from music score layouts, and will require detailed presentation, as we believe it is quite novel and could find many other applications.

7   CONCLUSION

VIP is inspired from an earlier prototype demonstrated internally at the hospital, handling about 4000 patient cases. Yet, confidentiality and safety reasons make it very difficult to test in extenso and therefore committing to its effective deployment for everyday use. A new, more robust version is being considered to make its deployment effective. Separately, VIP is to be released as an Open Source version, for use in a variety of contexts where indicators can be extracted from collections of time-stamped documents.

8   ACKNOWLEDGEMENTS

9   REFERENCES

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