



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

A better visualization for EPFL's IS-academia

Thibault Urien
Alvaro Pinedo Camacho
Jonathan Scanzi

Fall semester 2017

Introduction

For masters students, in particular CS students, planning their course schedule can be quite challenging. The problem lies in the fact that there are many requirements for completing a master degree and many options. For example, they can choose to take a specialization. If they do so, a total of ECTS 120 credits must be earned instead of 90. The extra 30 credits must come from a subset of courses that are part of their desired specialization. Regardless of this, they must also choose 15 credits from a subset of "mandatory" courses. The complexity comes from the fact that courses can be both mandatory and from a specialization, which leads to an incredibly high combination of course schedules that could suit a student's needs.

As one would expect, planning this can be quite difficult. The current platform used to register for courses, IS-academia, offers a very impractical visualization of the courses schedule and doesn't display properly informations about credit advancement. Moreover its interactivity is very limited. The goal of this project is to allow students to plan their schedules in a much more efficient way, as well as providing them with lots of useful data represented visually.

Getting the data

Unfortunately, the data we needed was not available as-is. Thus, it was necessary to recover the data by ourselves. IS-Academia offers both public and private access to its course databases. Thus, we elected to run through the publicly available website, and recover all relevant informations we needed. This means recovering the basic data like name, code, summary, as well as data that we needed to make a better scheduler: credits and specialization. Recovering this data was not straightforward, because there are two main sites that hold this data, with completely different structures, and missing information. It was then necessary to run through both of them to recover all the data, which proved to be long to do.

The point of was the public ISA database¹, which is where the names of the courses and the teachers are recovered. However, this page is missing many information that we needed for our scheduler, like of course the

¹http://isa.epfl.ch/imoniteur_ISAP/!GEDPUBLICREPORTS.htm?ww_i_reportModel=2096516523

timetable. To get this data, we had to use a different website separate of ISA². This one has a list of all courses, with many informations, in particular whether or not the course is part of the mandatory block, which is not shown anywhere else. And in addition to that, every course has a link to their detailed page, which has everything we need. In retrospective, this list was the only reference we needed, but we discovered this after already scraping the first website.

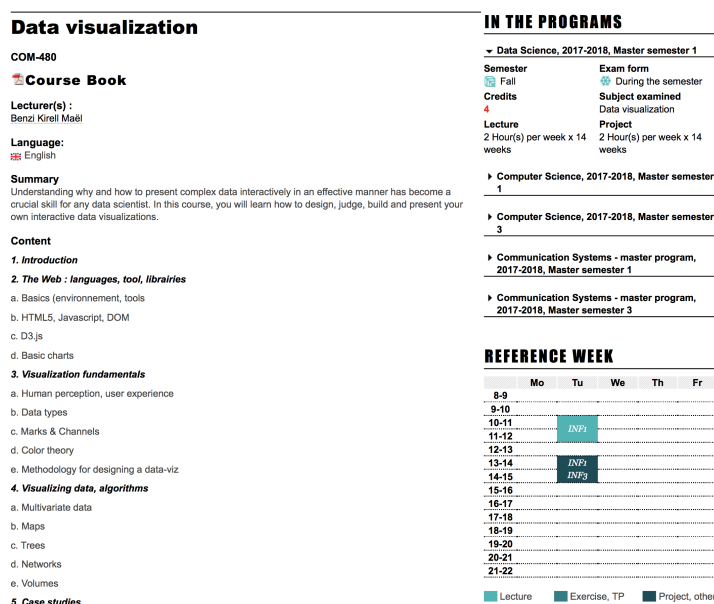


Figure 1: This page holds almost all the information we need to make our scheduler. We had to crawl through this kind of page for every course.

²https://ic.epfl.ch/computer-science/study-plan_master

Building the schedule

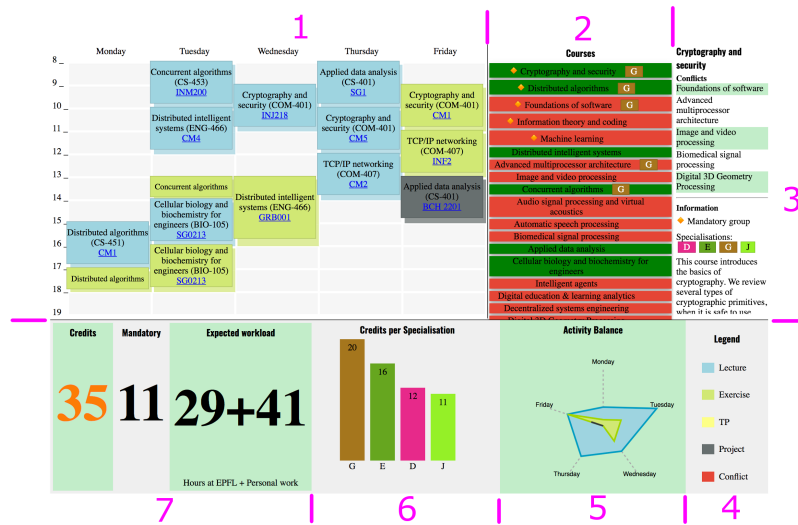


Figure 2: Design in the first iteration

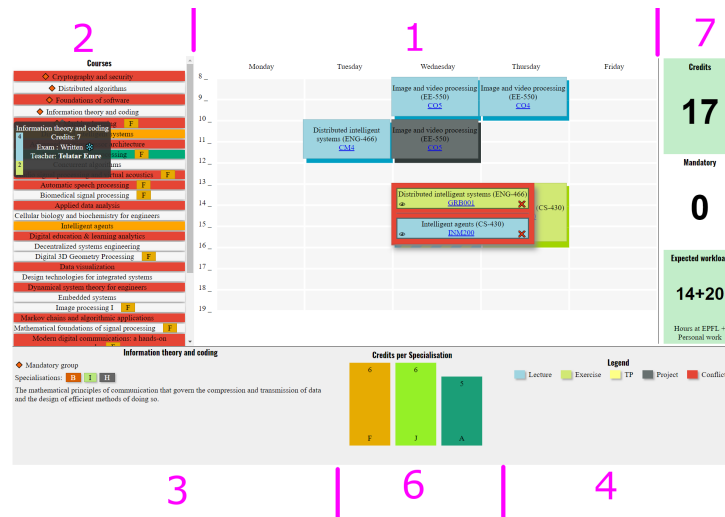


Figure 3: The final design

With this detailed view for every courses, we were finally able to build our dataset with all relevant information. This includes timetable with room

numbers, credits, short description, and many details about the exams and the recommended courses.

Due to the difficulty in getting data, for now the data is centered around the Computer Science schedule, and only accounts mandatory credits for this section (Communications System students have a different set of mandatory courses, and need 30 credits instead of 15).

The focus of our visualization is to avoid conflicts, keep track of specialization, and get a better understanding of the workload the student should be expected to have. All these information are clearly visible. The targeted users are students from EPFL and this visualization aims to be a replacement of the scheduler in IS-Academia.

The different methods to visualize each of the parts of our data are described in the following subsections.

Timetable

You can see the Timetable in Figures 2 et 3 in regions 1. The ISA scheduler does a poor job of showing conflicting courses. The student must either enter all the courses they want to take, then take a good look at the schedule, or take all information from their courses to an Excel sheet, and do the scheduling themselves. But the biggest problem is that on many displays, the timetable do not fit on the screen. That prevent the student to have a clear overview of his schedule in one glance.

Since the beginning of our project we decided that we should optimize the usage of space so that everything can be displayed in the available space. To achieve this goal we gave to the timetable cells of size depending on the space available instead of the size of the content. Then we changed the amount of content and the font size in each cells so that it fits.

To find more space we implemented a function that merge neighboring cells when possible. Then we realized that when displaying conflict, the space available in the cell may not even be enough to display the entire course name. For this reason we made the cell click-able. Clicking a cell expands it over the neighboring cell. As seen on Fig.3 and Fig. 5 When the cell is expanded informations are displayed for each course using the time-slot. More over for each course we added a cross and an eye button. The cross button remove the course from the selected course list which allow the user to resolve the conflict from where he spotted it. The eye button change the course displayed in the description section. When changed this way the description

will flash in purple to attract user attention. It avoids the user not realizing what changed when they clicked the button.

In the first version of the timetable, the text content was displayed directly in the background cell (that are svg rect). But then we realized that using a div would be much more convenient. From here came the idea of making the div popping from the list button when the course is enabled. More than for looking fun, this effect guide the vision of the user from the course in the list he just clicked to the change caused by this input. Sudden move from the center of the point of view are likely to cause an eye saccade, like when reading, that should at least provide the reader a good awareness of the locations of change on the table.

We implemented this new functionality without removing part of the old code that were updating the gray svg cells, which resulted in cells have a "shadow" of their color. We decided to keep it like this as it make the timetable look more click-able, but also because we can use this to display additional information. In case of conflict, the cell turn red to clearly show the conflict, but the background retain the color of the activity, so that the user now what kind of activity are conflicting, see Fig. 4. This information is really useful as conflict can be more or less acceptable depending on the conflicting activity. For example, a conflict between a project and an exercise is less annoying that a conflict between two lectures. When the conflicting time slot have different activity, the shadow displays a dashed pattern made of all the color codes of the conflicting activity. If this slot is surrounded by other slots, this shadow looks like a line around the slot, which remain visible, Fig. 4.

Latter while debugging the program, we noticed that it could be useful to filter to find course from time-slot. That why we made the day labels, the course label and the background cell in the table can new be clicked to set up labels in the timetable.

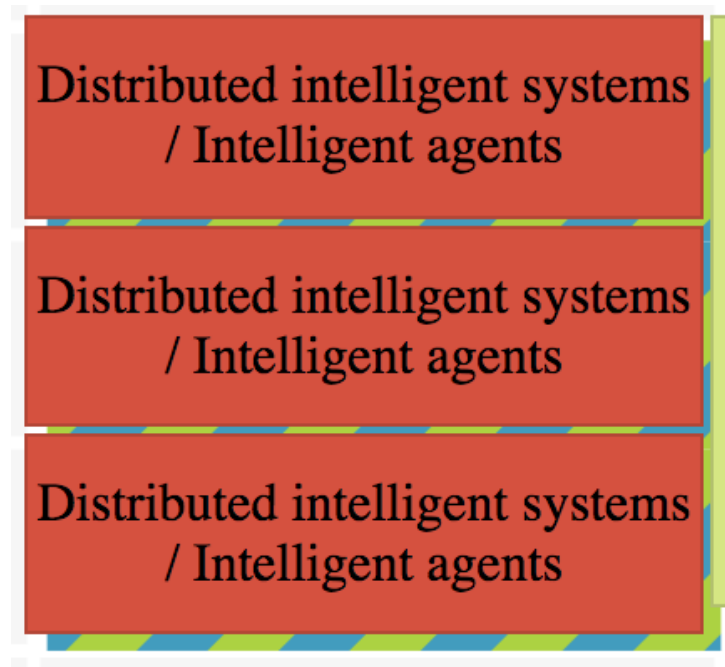


Figure 4: Here we can see the intertwined shadows.

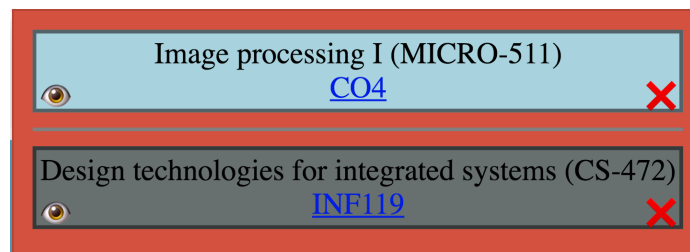


Figure 5: Here we can see the view of 2 conflicting courses on the schedule.

List of courses

Every time someone wants to choose their courses from IS-Academia they have to choose them from the list of course, save the changes and refresh the site to see the changes applied. This course list provides all the necessary interactions for the user to select its courses easy.

The list of courses can be see in both Figures 2 and 3. The main difference between both figures resides in the color of the selected courses in the list.

This list was designed to show all the courses someone could select for its schedule and clicking on them would insert the course on the timetable. Clicking again on it would erase them from the table. The initial design was very simple, only a check-box with the name of the course at the right side, no colors used.

This very basic design was changed to be more user friendly we removed the check-boxes and transformed the entire name of the course into a clickable button that would add or remove the course from the timetable depending on its current state.

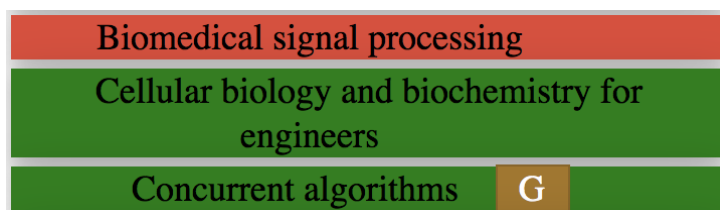


Figure 6: Initial color set for conflicts and chosen courses.

To make this state easier to visualize the colors were added. Red indicated all the courses in conflict with all the courses selected. Green was for the selected courses without any conflict among the currently selected courses. See Fig. 6 And orange indicated the selected courses that are in conflict with another course selected.

Further details were added at the same time we added the initial colors. As it can be seen in Figure 3 when you move your mouse over a course inside the list a tool-tip appears with the information details of the course like the different activities in a chart with the respective hours, the number of credits, the type of exam and the teacher of the course. See Fig. 7

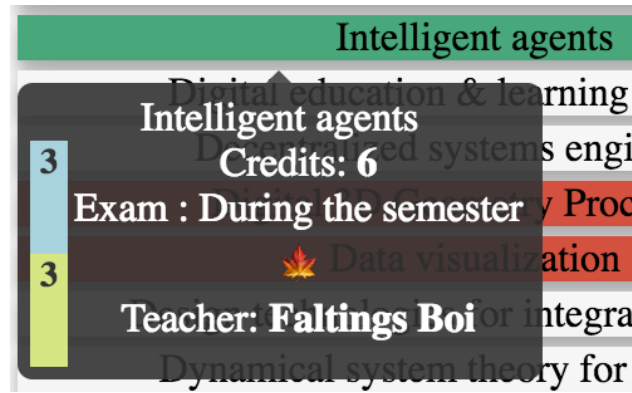


Figure 7: Some details on the courses and what kind of activities it entails.

The details of the course and the description of this one appear on the region 3 of Fig. 2 and refresh each time the user moves its mouse over the course the user want to know the informations from. It is also possible to display them by clicking on the eye that appears inside the cell of a course after selecting it at the timetable. Those details also show the list of conflicts of the chosen course. See Fig. 8

Audio signal processing and virtual acoustics
Conflicts
Concurrent algorithms
Distributed intelligent systems
Foundations of software
Information theory and coding
Advanced multiprocessor

Information
Specialisation: F
The objective of the course is to introduce theory, methods, and basic psychoacoustics that is needed to understand state-of-the-art techniques used in

Figure 8: Our original conflicts list, with courses already in the schedule on top.

A lot of interactions have been added from all the web site. The user can click in almost anything and get information in the list of courses. If the user wants to know which courses have hours on a Monday the user can click in the Monday tag from the timetable or the workload, from Fig. 2

region 5. This is also applied to hours and the more precise cells of the timetable (Monday at 8h). The user can also see which courses belong to a specialization by clicking on that specialization in the description of the course or the specialization chart. Clicking on the number of credits the number of credits appear next to the courses on the list. Finally, if a user wants to know which courses have a particular activity type.

An orange diamond indicates which courses are mandatory.

As the organization was pretty messy we decided to change the region 3 from Fig. 2 to put it on the bottom as it is shown in Fig. 3. We deleted the conflict list since it was not extremely necessary and was taking too much space.

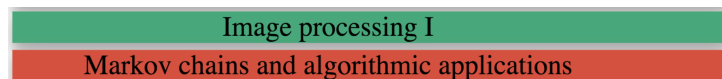


Figure 9: The colors chosen should not pose any problems to colorblind students.

As color-blind people may have trouble distinguishing red and green, green was changed to a mix between blue and green. See Fig. 9

Specializations

You can see the Specialization plot in figure 2 3 in regions 6. Another important issue for IC students is choosing a specialization. While not mandatory for Computer Science students, most of them take one since it offers an opportunity to focus on studying a particular aspect of the discipline. However, doing this requires to validate 30 extra credits, that must be chosen within a specific subset of courses. Once again, ISA does not do a good job of communicating where the student is regarding these credits.

With our scheduler, the student can see how many credits the schedule would give them for every specialization with an interactive bar chart. The chart display the four specialization the student have the most credit in, which allow a student to choose specialization just by taking course that interest him. See Fig. 10

Moreover, each bars can be clicked to mark course in the list that belong to the corresponding specialization. As a student need to take only one specialization, this way of showing it provide just the useful information. In

the first version, the bar chart was not click-able, instead the specialization with the most credits was marked in the list with small colored labels. In this version, those labels were not used for anything else. We then realized that sometime, the user may select a combination of course where multiple specialization have the high number of credit. Moreover, during the process of selection, the user may enable course in a order that rank first a specialization that is not the one that the user want to take. In order to solve this, we made the bar click-able so that the user can indicate the specialization he is interested in. While using our application, this way of visually filtering course appear quite efficient to us. So we decide to use it also to implement other type of visual filter.

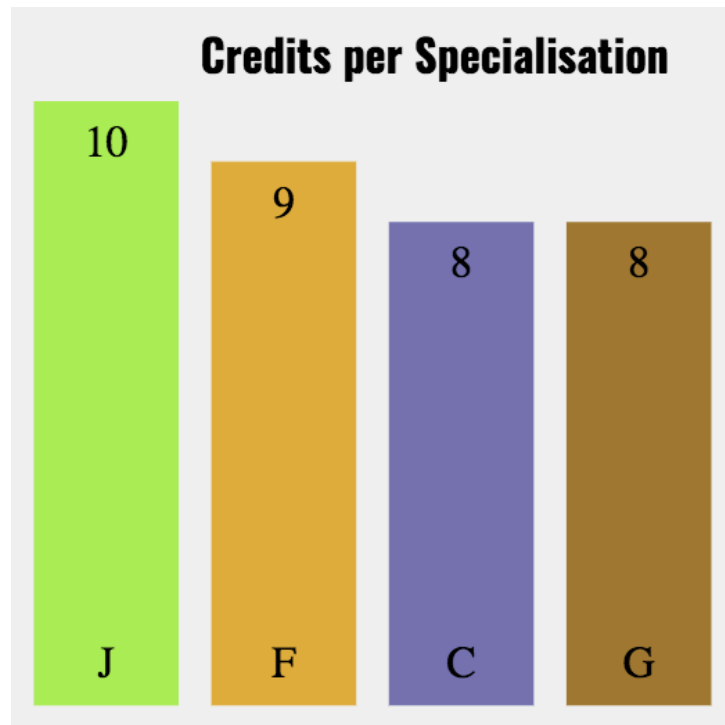


Figure 10: Example of the char representing the number of credits per specialization chosen.

Activity balance

You can see the Activity balance in figure 2 in regions 5. Rather than just showing the schedule in a timetable. Our scheduler also offers extra visual

information. Most notably, a star plot shows the student how much workload they will have for every day. See Fig. 11 The goal of this plot was to summarize the schedule. But when showing our project, we were told that the information density was already quite high. As this star plot wasn't that useful, we decided to remove it.

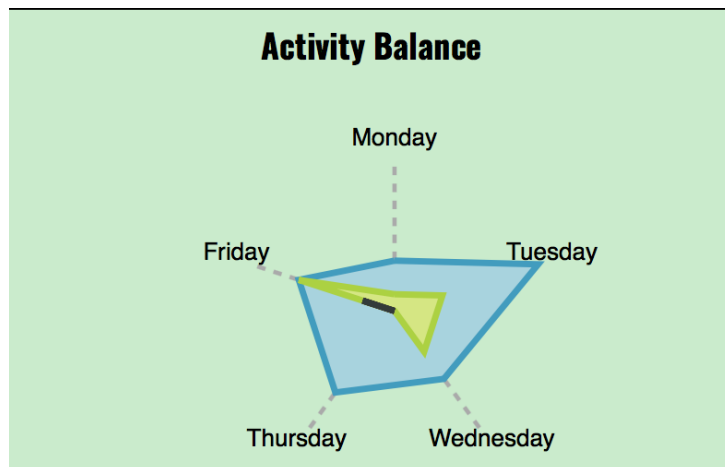


Figure 11: This is the activity star-plot that we eventually decided to cut.

This plot could be put back into the design if we managed to make it more useful by computing how the hours could be distributed each day in order to prepare before the next day and redistribute the personal work the user should do in addition to the work to do at the EPFL.

Legend

You can see the Legend in figure 2 3 in regions 4 and Fig. 12 for a zoomed version. As we suppose that most of the potential user for our application would be used to IS-Academia schedule, we decided to use the same color code for activity to reduce the number of things our new user would have to learn. Then while working on the specialization plot, we had this idea of using label in the course list as a visual filter, so we implemented a labeling from element of the legend. We made all activity click-able except conflict. When clicking on an activity, all the course that have this activity are labeled in the list. Conflict was the only exception as conflicting courses are already identifiable in the list from their background. Latter, as we removed the

conflict list, it come to use a way to use this button. Now when clicking on conflict in legend, all course in conflict with a course enabled by the user receive a label. This label contain the number of hours and the number of course that cause a conflict. If the user end up in a situation were he cannot select a course without creating a conflict, this label may help him to find the less annoying conflicts : the one that only have one hour in conflict. It can also help him to see which conflict may be easy to resolve because they are caused by only one other course.



Figure 12: The color scheme used is the same as IS Academia. This has been chosen because Masters students are well acquainted with these colors

Big numbers

You can see the Big numbers in Figure 2 3 in regions 7. The idea of those numbers is to show to the user how many credits they have chosen, how many are mandatory and how many hours of work thee user will have to do with the selected courses per week.

The three parts:total 'credits', 'mandatory' and 'expected workload'. Number of credit and mandatory credit is is very important information for a student that construct his schedule, but we also wanted to put emphasis on the invisible workload.

The EPFL provide a simple formula to compute this workload : for one credit you have to work one hour in scheduled EPFL activity and one hour on you own. While this rule is very simple, many student don't know it or forget it when making a schedule, or even worst : during the year when they overestimate their actual amount of free time. But a number that display the number of credit two would be would looked as stupidly useless to our user as so reduce the impact of our message. We could also just put a reminder of the formula, but that wouldn't be as much untactful as a big number. That why we decided to display as uncomputed sum : sum of scheduled hours of activity plus sum of hours of autonomous work. Those number are much more interesting. First some bachelor teacher tend to schedule a lot of exercise session that student can receive more help. For those courses,

a bigger amount of work is put on the schedule so you need to work less on your side. But the opposite also append. Moreover, in case of conflict, we assume that you can only attend one of the two activity. That mean on the left number we just count the number of used time slots and the activity you cannot do because of conflict are reported on the right number. Displaying thing like this allow the student to consider separately the hour on the schedule from the other, knowing the first ones interesting but the seconds not being scheduled by the epfl the student have to question himself on his strategy to deal with this right number.

We put those numbers in the bottom-left of the website were the eye attention would not be permanently caught by the constant animation of the credits changing with the selected courses. It was positioned in order to be a region were the user could see it with the corner of the eye.

After the reorganization of the structure of the website this region was moved to the top-right were it will take less place but allows us a better organization. See region 7 from Figure 3 and the Figure 13



Figure 13: This shows how the credits count turns gold to indicate a the student have scheduled a semester of at least 35 credits which is considered as the norm.

Conclusion

We thus offer a course scheduler that addresses some of the issues that plague the ISA scheduler. Most notably, by giving the student much more information on what their chosen schedule will offer in terms of credits advancement, and in terms of how much workload this will represent. Naturally, there are some limitations with this scheduler. Most notably, the courses data comes from purely publicly available sources from ISA, and probably contains less information than what is contained in the internal database. This meant that we restricted our scheduler to work on a single semester, and thus prevented

us from doing the projections for future semesters that were planned at first. But as it is now, it offers a good look of what ISA could do to make planning one's Masters study plan more efficient, and much less frustrating.

Peer Assessment

Preparation: Almost all the changes to be made were decided during meetings of a short time when everyone was available. Mainly during the project sessions and Fridays.

Contribution: Every member of the group came up with different ideas and during the meetings those ideas were discussed and modified in order to fit in the project.

Respect for other's ideas: Sometimes we had hard times to decide which was the next step to make in the project. However, respect was always present during the debates. This happened mostly when we had to decide whether to keep the conflicts list and the activity workload plot or not.

Flexibility: Everyone was eager to listen to the others to improve their ideas.