Lisa Asticher
Universität Bern
Kompetenzzentrum für Public Management KPM
Schanzeneckstrasse 1
3012 Bern

lisa.asticher@unibe.ch

CAS ADS – Final Project

Predicting Openings and Closings of Hospital Locations in Switzerland

07 July 2023

Abstract

This project aims to investigate the centralization of hospital services and regional strategies within the healthcare sector in Switzerland. Using quantitative methods and machine learning models on publicly available hospital data, the analysis seeks to predict the opening and closing of hospital locations based on local economic and political data. The results reveal that the models employed did not outperform random chance in predicting these events. Challenges such as data imbalance and limitations in data quality were identified, emphasizing the need for refined approaches and more comprehensive datasets. The forthcoming dataset from the Swiss Federal Statistical Office (FSO) is expected to address some of these limitations and enable more accurate analysis. Future work will involve further refining the analysis framework, exploring alternative techniques, and incorporating additional variables for enhanced predictions and understanding of regional hospital strategies.

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Introduction

The organization of healthcare services within a region or a country is a hot topic, at the crossroads of many interests, between citizen preferences, public health and state duty, cost minimization, or even profit generation. In a context of ever greater liberalization of the healthcare sector, researchers are witnessing a trend towards the centralization of hospital services on a global scale (e.g. Baier et al., 2019; Postma & Zuiderent-Jerak, 2017). This issue is also very much alive in Switzerland, where plans to centralize regional public hospitals, involving notably the closure of key services such as emergency departments and maternity wards in outlying areas, are regularly making headlines and agitating the political realm. Examples include the "initiative for two hospitals", which tore the canton of Neuchâtel apart until it was accepted in February 2017, or more recently in Fribourg, the popular initiative for 24-hour emergency care, opposing the closure of the Rivaz and Tafers emergency sites, which is still awaiting a popular vote.

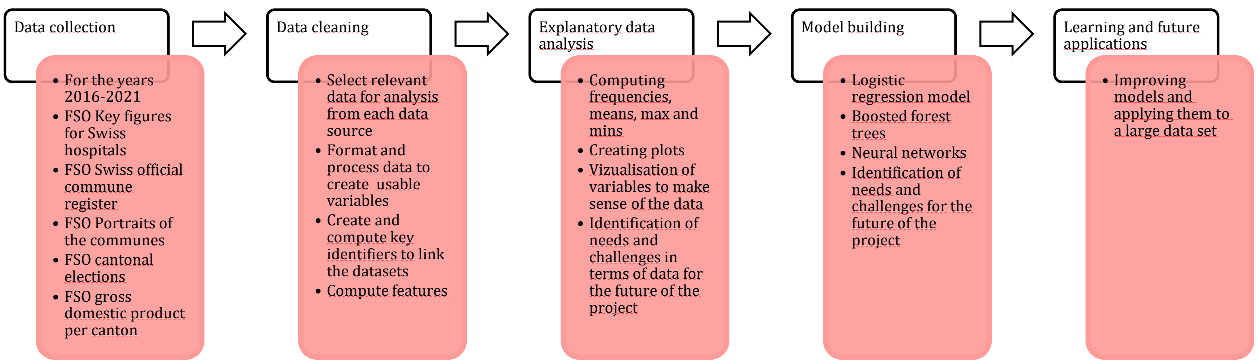
In light of these economic, political and social upheavals, it appears interesting to investigate the phenomenon of centralization in regional hospital strategies from a quantitative perspective, not least to also better understand how these are determined by local economic and political factors. The concepts and approaches studied as part of the CAS in applied data science are good tools for tackling this ambitious task. This project is further part of a doctoral thesis in public administration, which analyses reforms in the Swiss healthcare sector. In this sense, the project and this report consist of an initial phase of data collection and processing, as well as the development of an analysis that should eventually lead to the publication of a paper in a political science journal. The ultimate aim for the paper is, via the analysis of hospital data disaggregated specifically for this purpose and made available by the Swiss Federal Statistical Office (FSO), to predict the closure of key services, namely emergency departments, maternity wards and operating theatres, in outlying areas, using local political and economic data. As the data required for this work has still not been delivered by the FSO as of July 7, the present CAS-ADS project is based on an analysis of publicly available, much less detailed data, and focuses on the analysis of the opening and closing of hospital locations in Switzerland. This first analysis aims to set out a framework for the remainder of the thesis project, including model testing and identifying future opportunities and challenges.

Following this brief introduction, the rest of this project report consists a presentation of the data, data flow, data quality, prepocessing and datacleaning, followed by an exploratory analysis and then machine learning tests. The results of the various analyses are then discussed. The report ends with a brief conclusion and outlooks for the next stage of the project.

Data

The data for this project stems exclusively from the official website of the FSO, the Swiss Federal Statistical Office. As my demand for desaggregated data on the location-level is still pending, the data for these first analyses was gathered online and consists therefore exclusively of publicly and freely available data. The aim of the project, that is to identify local political and economical factors driving hospital strategies on the ground, constrained by practical realities, led the gathering of the data. I collected data from four different sources: the cantonal portraits, the municipality portraits, the hospitals key numbers, as well as the official municipality register. Data flow is illustrated in Figure 1.

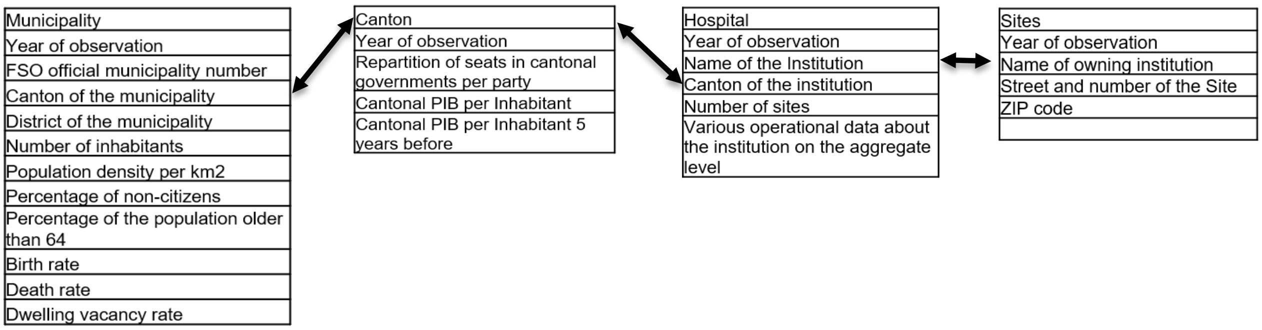
Figure 1 Data Flow



Challenges were faced at most of the phases illustrated in Figure 1. With regard to data collection, the fact that I had to search for data on the Internet, particularly concerning hospitals, made the work tedious and time-consuming. Hospital data for each year had to be retrieved from different sources. Because of the availability of online data, it was only possible to go back as far as 2016, as the datasets for previous years did not provide information on the location of hospital sites. For most of the data, the issue of consistency over the years also proved central. It was therefore necessary to search for and reconstruct data sets to guarantee the uniformity of variables by year for all sources. Pre-processing also proved tricky. Not all the sources necessarily used the same key denominators, which made associating the data with each other particularly complicated. In the case of hospitals, for example, hospital institutions and their sites do not have identifiers, so creating an identifier based on the address and name of the owning institution is not infallible. The names and numbers of communes in the various lists did not all correspond, it was therefore necessary to manually search for outliers, which was also proved not infallible. Subsequently, when it came to analyses and models, the nature of the data and the small size of the dataset meant that it wasn't possible to go all the way. However, some interesting avenues were explored.

It has indeed been possible to collect a certain amount of data and process it into a – even if not ideal – still usable dataset, as illustrated in the logical data model in figure 2.

Figure 2 Conceptuel Data Model



As shown in Figure two, it was possible to link the dataset together and create common key features, also through the use of the FSO official municipality combined with the name of the municipalities and the ZIP codes, which allowed creating a common ground for each municipality and hospital site. Afterwards it was easier to connect the cantonal and hospital datasets. From there, it was possible to compute new variables, such as a unique identifier for each hospital site, the number of sites per municipality, the number of sites per inhabitant or the number of sites owned by a public institution in each municipality. By combining the datasets across the years, it was also possible to compute the two depenent variables: 1) whether a new site opened in the municipality or not, and 2) whether a site closed in a municipality or not. The detailed list of the computed variables and the variables used in the analysis is in Appendix 1.

There are a number of things to note about data quality. First, the identification of municipalities on a common variable had to be done via the official directory of Swiss municipalities and was based on the 2023 list. This means that it is not possible to take account of changes in municipalities (e.g. mergers), which results in missing data when a municipality disappears from the register between 2016 and 2021. Second, the identification of the sites is based on the address combined with the name of the site, combined with the name of the institution. This is sometimes imprecise, and runs the risk of falsely identifying site closures and openings. Also, the absence of a unique identifier over the years for both institutions and sites makes the identification of repurchases of sites between institutions redundant. These cases, which are probably common, are indeed recorded twice: once as a closure and once as an opening. Generally speaking, the way in which site openings and closures are accounted for is not optimal. It should also be noted that the notion of site in this particular case does not at all take into account the activities on the site. All sites and institutions are lumped together, regardless of their activities: whether it's an ophthalmology centre or a general hospital. The forthcoming FSO data will resolve this problem, as it will contain identifiers by site and by institution, as well as information about the services provided on each site.

Exploratory Analysis

As shown in Table 1, the final dataset consists of 11115 observations, of which 2420 contains at least one NaN. The number of observations decreases with the years as a result mostly of municipality mergers, a big trend in Switzerland. Municipality mergers are not a problem per se but, as mentioned before, it makes the identification of unique sites and the consistency of the data per year complicated.

Table 1 Observations and NaNs per year

Year	Observations	Rows with NaNs
2017	2289	186
2018	2240	578
2019	2212	521
2020	2202	593
2021	2172	542
Tot.	**11115**	**2420**

Table 2 summarizes a few key variables, helping understand the distribution and the structure of the data. The percentage of left-wing voters, social assistance rates and cantonal GDP per capita, appear to be better distributed, with greater ranges of variability. It should be noted, however, that a left-wing majority in a commune remains an outlier. Similarly, the rate of social assistance remains generally low, averaging 2.17%, but with exceptions including a maximum of 13%. As for the social assistance rate, it should also be noted that this variable contains a lot of missing data (see Appendix 1). The main reason for the missing data is the protection of individual data, i.e. some small communes have a low number of beneficiaries, who are therefore easily identifiable. Cantonal GDP per capita also shows particularly high values compared with the average.

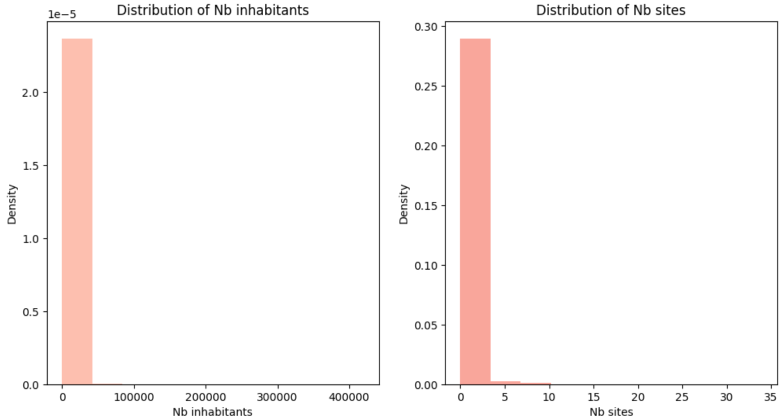
Table 2 Summary of key variables

	Nb inhabitants	Nb sites	Sites per inhabitant	% left voters	% social assistance	Cantonal PIB per inhabitant
min	11	0	0	0	0	52579.83453
25%	688	0	0	15.6021557	1.065644647	64084.08115
50%	1507	0	0	21.69304487	1.710542508	72119.00085
75%	3682	0	0	29.57268924	2.78204916	77027.44104
max	420217	34	0.0041841	63.22896526	13.07011573	196189.1215
mean	3812.988394	0.256050382	4.06E-05	22.90484943	2.16715807	73612.46192
std	12471.24378	1.366627111	0.000201994	10.48322323	1.664733572	14235.7134

As we can see the number of inhabitants, the number of sites, as well as the number of sites per inhabitant tends to be very low. Indeed, only in the fourth quartal do the number of site and the number of sites per inhabitant go beyond zero. This is mainly due to the size of the majority of the municipalities in Switzerland, which are mostly not considered cities, as municipalities in the

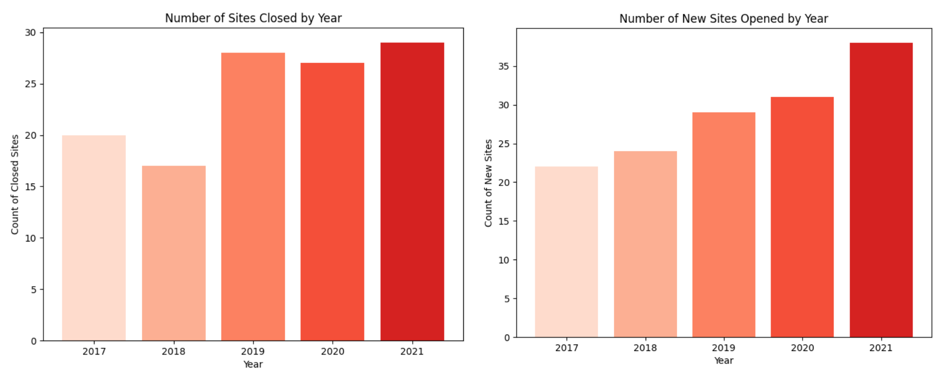
75th percentile have no more than 3700 inhabitants. This obviously represents a challenge to consider for the analysis, since this distribution implies an imbalance in the data, with a strong over-representation of cases where no hospital is present. The distribution of the number of inhabitants per municipality, as well as the number of sites per municipality are further illustrated in Figure 1, where we can see the extreme dominance of municipalities with fewer than 5,000 inhabitants, as well as municipalities with no hospital site.

Figure 3 Distribution of the number of habitants and sites



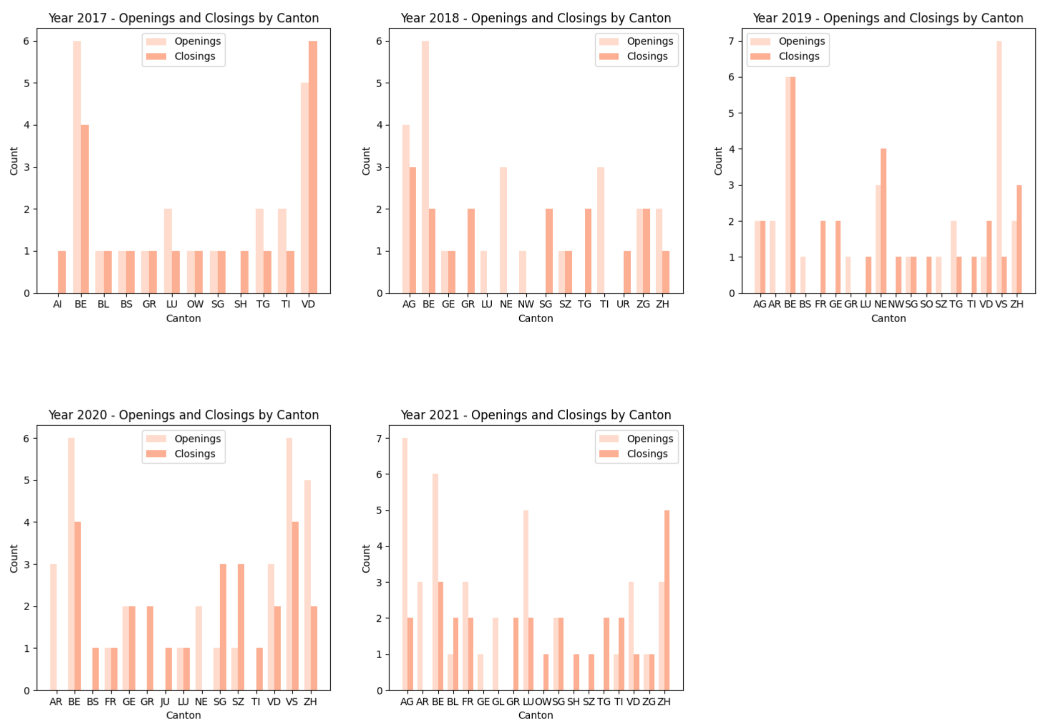
Despite this unfortunate distribution, it's worth taking a closer look at the sites, and in particular the open and closed sites. Figure 4 shows the number of site openings and closures per year in Switzerland.

Figure 4 Openings and closings per year



Overall, it appears that slightly more sites opened than closed between 2017 and 2021. However, as shown in Figure 5, while the overall number of sites tends to increase slightly over the years, it appears that closures and openings are not uniform across all cantons over the years. While some cantons observe more opening some years, other observes inversed tendencies.

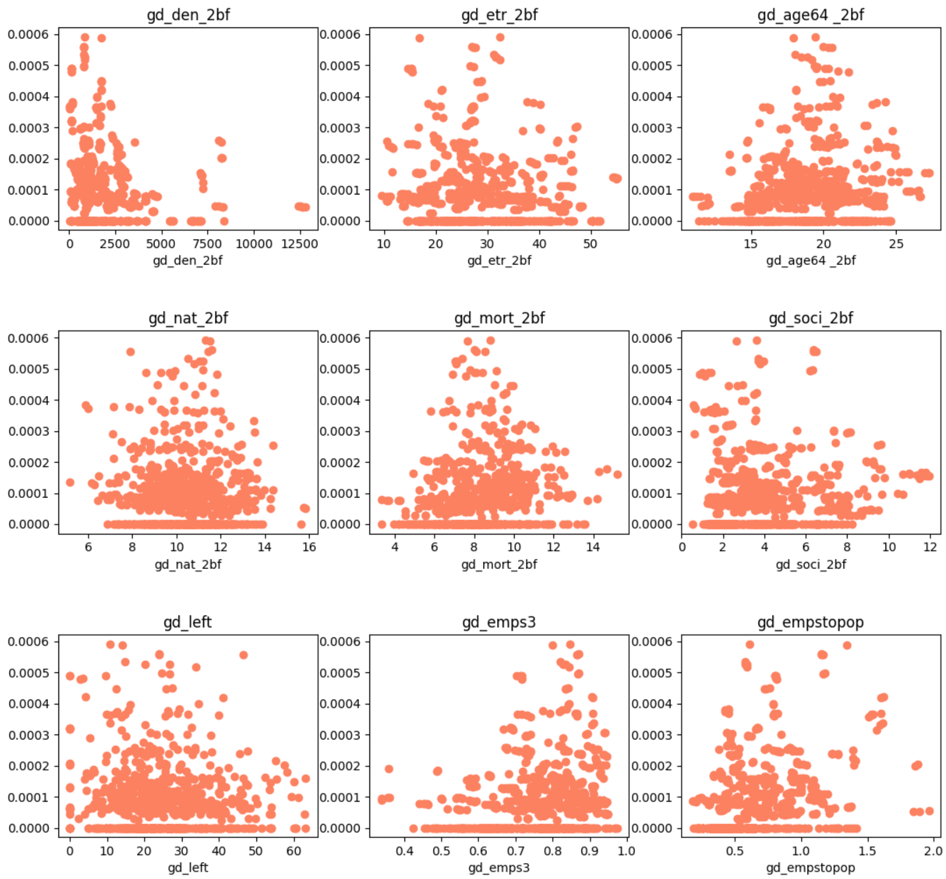
Figure 5 Openings and closings for years 2017-2021



An initial insight into the relationship between variables at the municipal level and the number of hospital sites per capita, which can help us understand were sites are closing and opening, is presented in Figure 6. Figure 6 focuses only on the municipalities that have at least 10'000 inhabitants. The number of hospital sites per habitant is plotted in relationship with the number of inhabitants (gd_den), the percentage of non-citizens (gd_etr), the percentage of retired people (gd_649), the birth rate (gd_nat), the death rate (gd_mort), the percentage of social assistance (gd_soci), the percentage of left-wing voters (gd_left), the percentage of people working in the tertiary sector (gd_emps3), and the percentage of people employed (pg_empstopop).

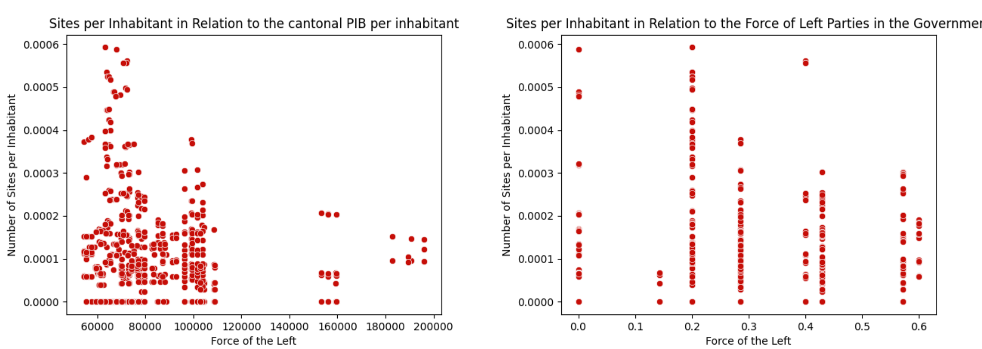
Overall, it is to note that bigger municipalities and municipalities with higher social assistance tend to have less hospital sites per inhabitants. Up to a certain point, it appears that there are more hospital sites in municipalities with older people. Furthermore, it looks like the higher the percentage of people working in the tertiary sector, the higher the number of hospital sites per inhabitants.

Figure 6 Hospital sites per inhabitants in relation to municipality's characteristics (10'000+)



Surprisingly, the cantonal analysis might indicate a negative relationship between the PIB per inhabitant and the number of sites per inhabitants. Furthermore, the force of the lefts parties in the government does not seem to correlate with more hospital sites, as shown in Figure 7.

Figure 7 Hospital sites per inhabitants in relation to canton's characteristics



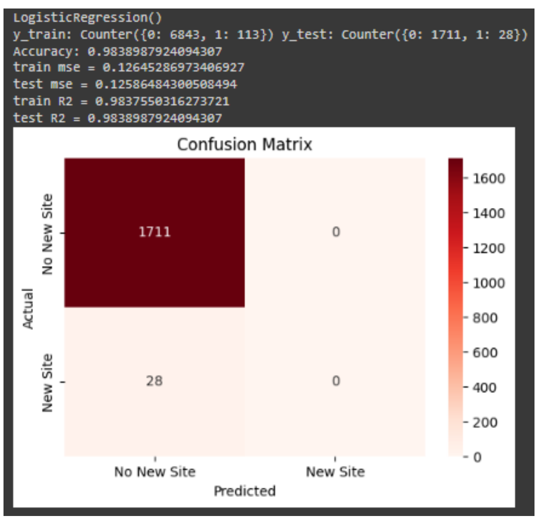
Machine Learning Analysis

I implemented various supervised learning models in order to see wether it was possible to predict the closing of the opening of a new site in a given municipality, starting from a basic logistic regression. Having established that the risks concerning the effect of data imbalance were confirmed, I tested different rectification possibilities, implementing them in boosted trees. I further experimented with neural networks models. I end the analysis with a Random Forest Regressor to have a deeper look at feature importance.

1) Logistic regression

I started by implementing a basic logisitic regression model to try to predict the opening of a new site. The results of the model are illustrated in Figure 8. The model is quite accurate, but actually not working as it predicts exclusively that no new hospital site will open. This result is expected, mainly because of the huge data imbalance between the opening and the non-opening of new sites.

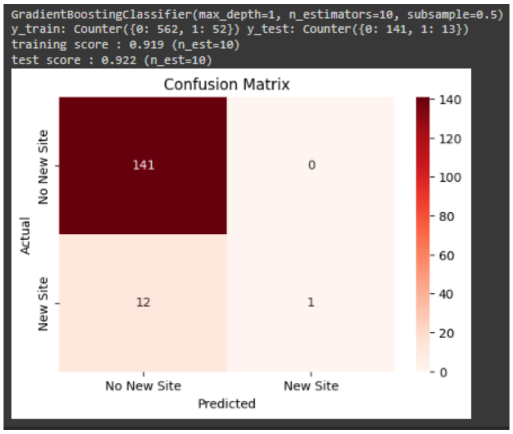
Figure 8 Logistic regression results



2) Data imbalance & boosted trees

I first tried to implement boosted trees without first working on the data imbalance, which was highly unsuccessful. My first try after that was to use a manual undersampling strategy, where I deleted all observations were the number of inhabitants were inferior to 10’000, that is keeping only municipalities considered as cities, and deleting the villages. I then tried to find the best number of estimators using a grid search function from sklearn.model_selection. The results of this model are illustrated in Figure 9. This model is only very slighly less bad, as it correctly identifies one new opening. Despite a slight rebalancing, class imbalance remains an issue, with a ratio of about 1 to 10.

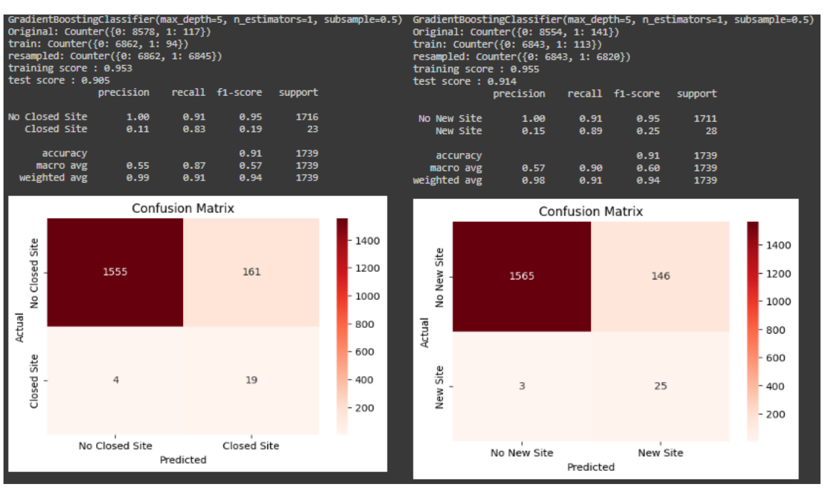
Figure 9 Boosted tree, undersampling



In a second step, I implement an oversampling strategie, were I artificially increase the number of positive observations to match its counter class. I use two different techniques for oversampling, namely by using the two packages SMOTE (Synthetic Minority Over-sampling Technique) or ADASYN (Adaptive Synthetic Sampling). I further try to find the best parameters for the model by implementing different loops for max_depth (1, 2, 3, 4, 5), n_estimators (1, 4, 10, 30, 50, 60), learning_rate (0.05, 0.01, 0.1), and subsample (0.5, 0.2, 0.1). Theses tests give me the final parameters for my model, which are specified in Figure 10.

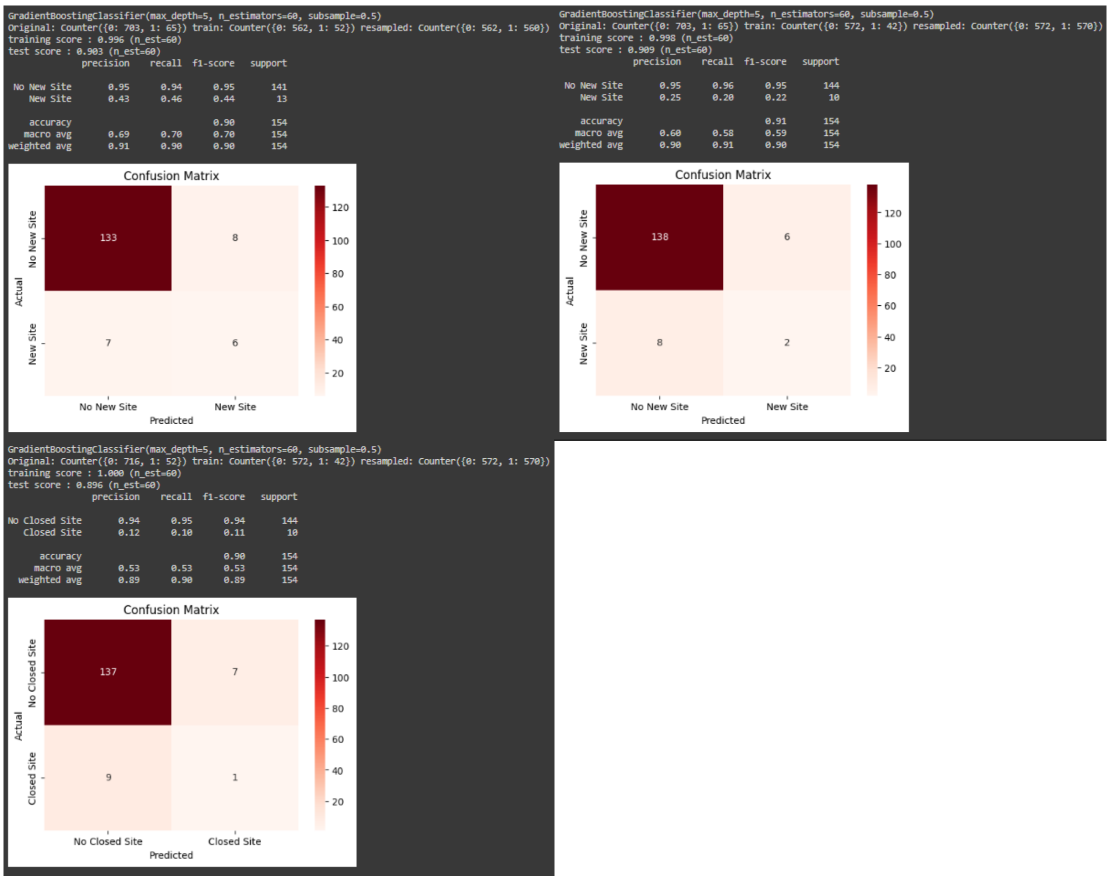
The models in Figure 10 show the prediction of the boosted tree using the ADASYN oversampling method on the opening and the closing of hospital sites. The model shows a similar test accuracy as before, however it starts predicting also a positive class. Although it doesn't do it very well, this first finding remains a success.

Figure 10 Boosted trees, oversampling with ADASYN



In a final attempt, I combine oversampling and undersampling techniques to see if this results in more reliable predictions. Figure 11 shows the results of this new model. This new model appears to work a little bit better, specifically for the model using the ADASYN sampling method for the new site prediction (Figure 11, top left). The SMOTE sampling method (Figure 11, top right) did not work as well with a precision of 25% only for predicting the opening of a new site. Interestingly, the same model with the ADASYN sampling method (Figure 11, bottom left) did not work for predicting closing, with a precision of 12%.

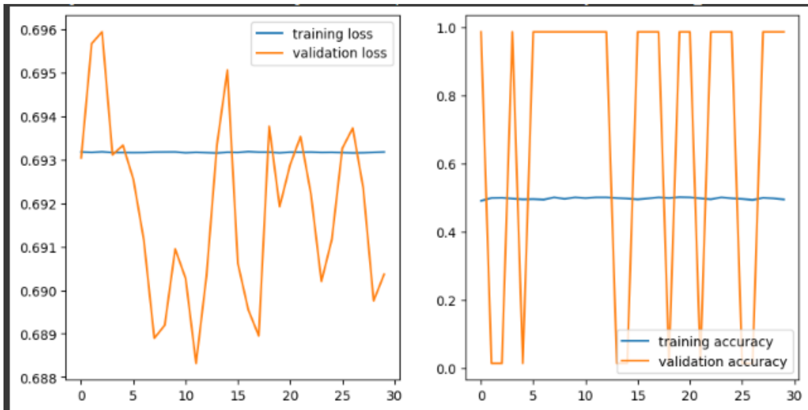
Figure 11 Boosted trees, oversampling over and undersampling



3) Neural network models

I've tried experimenting a little with neural models, but without much success. The problems encountered in previous models are repeated here. As shown in figure 12 below by way of example, accuracy validation goes back and forth between very weak and very strong, which seems to show that the model can't learn on the basis of the data it's given and that much of the classification process is done randomly. I applied the model on both the oversampled and the over and undersampled classes, without much difference in terms of success.

Figure 11 Neural network model




```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 16)                784

 dense_1 (Dense)             (None, 8)                 136

 dense_2 (Dense)             (None, 1)                 9

=================================================================
Total params: 929
Trainable params: 929
Non-trainable params: 0
_________________________________________________________________
None
```

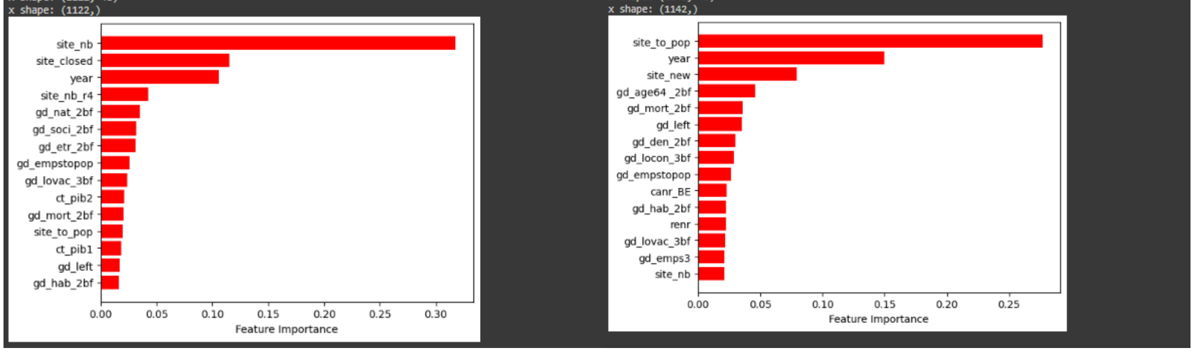
4) Feature importance

The results of the random forest regressor on opening and closing of sites, using over and undersampling are depicted in Figure 12. Interestingly, while the number of site per inhabitant is the biggest predictor in the model predicting the closing of a site, the biggest predictor for opening is the absolute number of sites in the municipality. It is also to note that an opening is a predictor for closing and vice-versa.

Figure 12 Feature importance

```
Original: Counter({0: 703, 1: 65}) train: Counter({0: 562, 1: 52}) resampled: Counter({0: 562, 1: 560})
x shape: (1122, 48)
x shape: (1122,)
```

```
Original: Counter({0: 716, 1: 52}) train: Counter({0: 572, 1: 42}) resampled: Counter({0: 572, 1: 570})
x shape: (1142, 48)
x shape: (1142,)
```



Discussion of the Results

The results of this data analysis project are those expected from the type, quality and quantity of data collected. None of the models was able to predict the opening or closing of a hospital site better than randomly: The best model being the one presented in figure 11, predicting the creation of a new site with the application of under and oversampling according to the ADASYN method, which correctly predicted the opening of a site with an accuracy of 43%, which is worse than random. There are many reasons for this result, and as part of a future project, it should be possible to counteract: 1) the quality and quantity of the data and variables used, and 2) the difficulties associated with data imbalance.

Of particular note is the low number of positive observations, where opening or closing is equal to 1. This is partly inherent to the nature of the data and of the Swiss system, with its many small communities and often regionally organized hospitals. Moreover, hospitals are massive institutions and, compared with other types of institution, not very volatile, in the sense that, unlike a burger restaurant, for example, hospital sites don't open and close according to the seasons. In this sense, it is more difficult to observe such a short-term trend. In this sense, the reduced number of years of observation also poses a problem. The future FSO dataset should provide data back to 2010, which should make it possible to identify more positive observations. Another issue is the quality and reliability of the variables to be predicted. The SFO dataset available online does not contain systematic information on the services provided on the site. Moreover, sites and institutions do not have a unique ID by which they can be identified, and lists, names and addresses are not always accurate. It was therefore difficult to create a variable that reliably recorded openings and closures. It is possible, for example, for a site to have changed name from one year to the next, and therefore to have been counted as both an opening and a closure, which obviously distorts the analysis and recognition of patterns. The same thing happens when a site changes ownership, for example when it is bought out.

In fact, it's relatively rare for a hospital site to close down completely overnight. Most of the time, they are rather transformed in their function. In this sense, services are more often transferred from one site to another than actually closed. This is the case in Fribourg, for example, where the emergency departments on the peripheral sites are closing, but the sites remain and are used for other purposes, such as rehabilitation or outpatient care. The list of sites includes all sites of all hospitals in Switzerland, from university hospitals to specialized ophthalmology clinics, without distinction. In this sense, identifying a closure or an opening, even more precisely by taking into account takeovers, does not necessarily mean being able to identify a pattern. The data set to be delivered by the FSO will contain precise data on the services provided at each site, in terms of emergency, maternity and operating theatres. This additional information should enable us to better identify movements within hospital systems, and thus create models for pattern recognition. It should also be noted that the data collected on municipalities and cantons should be supplemented by more information. This should be done in the next stage. Another important point concerning cantonal and municipal data in the models used in this CAS project is the lack of analysis of temporal trends. In this sense, it would be vital in the next stage of the project to indicate not only the absolute number of inhabitants in the municipality, but also the evolution of this number in the years preceding the observation. This obviously applies to all data relating to communes and the canton. Generally speaking, attempting to predict the current situation using data from the same period is not very strategic, since, as mentioned above, hospital issues are usually discussed in the long term and are the result of policies that have often been in place for a long time.

Another problem encountered in the analysis, which affects both data quality and imbalance, is the difficulty of combining hospital data with local political and economic data. An attempt was made to combine the two datasets to obtain one observation per communexhopital. This test was unsuccessful, as it created an immense quantity of observations while worsening the class imbalance. With the right parameters, however, this idea could be taken up again and refined.

In the final analysis, a major challenge for the project seems to be data imbalance. Oversampling seems to work only disappointingly well, so it will be necessary to find the right parameters to reduce the dataset in a meaningful way.

Conclusion and Outlooks

The organization of healthcare services, in particular the centralization of hospital services, is a complex and controversial subject with economic, political and social implications. This project investigates the phenomenon of centralization in regional hospital strategies in Switzerland using a quantitative approach, and analyzes publicly available hospital data to predict the opening and closing of hospital sites.

The results of the data analysis indicate that none of the models was able to predict the opening or closing of hospital sites better than chance. The limited number of positive observations, the inherent nature of the Swiss healthcare system and data quality issues pose challenges for the identification of patterns and trends. The next dataset from the Swiss Federal Statistical Office (FSO) should provide more comprehensive and reliable data, enabling more accurate analysis.

Data imbalance is another major challenge encountered in the analysis. Oversampling techniques have produced disappointing results, and it will be necessary to explore other approaches to reducing the data set while preserving meaningful patterns. In addition, combining hospital data with local political and economic data proved difficult, but could be revisited with refined parameters.

Looking ahead, there are several opportunities for improvement and exploration. The hopefully coming sool FSO dataset, going back to 2010, will allow identifying more positive observations and facilitate long-term trend analysis. It is crucial to improve the reliability and accuracy of variables related to hospital services and site identification. In addition, the inclusion of temporal trends, such as changes in the number of inhabitants, would provide valuable insights into the dynamics of hospital systems.

In addition, the project should continue to refine the analytical framework, carry out model testing and address future opportunities and challenges. The ultimate aim is to publish a peer-reviewed paper in a political science journal, contributing to the understanding of regional hospital strategies and their determinants.

In summary, although the initial analysis faced limitations and data challenges, it laid the foundations for future investigations. By addressing issues of data quality and imbalance, and incorporating additional relevant information, it is anticipated that more accurate predictions and insights concerning hospital site openings and closures can be obtained in later stages of the project.

Appendix

1. List of variables used for the analysis

Level of observation	Description	Source	Type	Value Range	Num Categories	Categories	Num Observations	Num NAs
Municipality	FSO official municipality number	FSO Swiss official commune register https://www.bfs.admin.ch/bfs/en/home/basics/swiss-official-commune-register.html	int64	1 - 6810	-	-	11115	0
Municipality	Number of inhabitants	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	int64	11 - 420217	-	-	11115	0
Municipality	Population density per km2	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.8601650587 - 12810.992462312	-	-	11115	0
Municipality	Percentage of non-citizens	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 61.1032197	-	-	11115	0
Municipality	Percentage of the population older than 64	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	5.813953488 - 81.8181818182	-	-	11115	0
Municipality	Birth rate	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 74.0740740741	-	-	11115	0
Municipality	Death rate	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 58.82352941	-	-	11115	0
Municipality	Dwelling vacancy rate	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 14.9446494465	-	-	11115	0
Municipality	New housing units per 1000 residents	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 180.0	-	-	11115	0
Municipality	Social assistance rate	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 13.070115725	-	-	11115	1941
Municipality	Percentage of left-wing voters in the population	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0 - 63.2289652592	-	-	11115	0
Municipality	Percentage of workers employed in the terciary sector	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.0365990990990991 - 0.9876160990712074	-	-	11115	296
Municipality	Percentage of employed people	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	float64	0.04293785310734463 - 4.811494252873564	-	-	11115	270
Municipality	Number of hospital sites	FSO Key figures for Swiss hospitals https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-spitaelern/kennzahlen-der-schweizer-spitaeler.html	Int64	0 - 34	-	-	11115	0
Municipality	Numbe of public owned	FSO Key figures for Swiss hospitals https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-	Int64	0 - 16	-	-	11115	0

	hospital sites	spitaelern/kennzahlen-der-schweizer-spitaeler.html						
Municipality	Number of sites per Inhabitant	FSO Key figures for Swiss hospitals https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-spitaelern/kennzahlen-der-schweizer-spitaeler.html	Float64	0.0 - 0.0041841004184100415	-	-	11115	0
Municipality	Creation of a new site that year	FSO Key figures for Swiss hospitals https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-spitaelern/kennzahlen-der-schweizer-spitaeler.html	bool	False - True	-	-	11115	0
Municipality	Closing of a site that year	FSO Key figures for Swiss hospitals https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-spitaelern/kennzahlen-der-schweizer-spitaeler.html	bool	False - True	-	-	11115	0
District	District of the municipality	FSO Swiss official commune register https://www.bfs.admin.ch/bfs/en/home/basics/swiss-official-commune-register.html	float64	101.0 - 2603.0	-	-	11115	543
District	number of hopital sites in in the district	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	Int64	0 - 43	-	-	11115	0
Canton	Canton of the municipality	FSO Portraits of the communes https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/communes.html	category	-	25	ZH, BE, LU, UR, SZ, OW, NW, GL, ZG, FR, SO, BS, BL, SH, AR, AI, SG, GR, AG, TG, TI, VD, VS, NE, GE, JU	11115	543
Canton	Percentage of left-wing members of the cantonal government	FSO cantonal elections https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases.assetdetail.je-f-17.02.06.01.html	float64	0.0 - 0.6	-	-	11115	543
Canton	Cantonal PIB per Inhabitant	FSO gross domestic product per canton https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/gross-domestic-product-canton.html	float64	52579.83453 - 196189.12153	-	-	11115	543
Canton	Cantonal PIB per Inhabitant 5 years before	FSO gross domestic product per canton https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/gross-domestic-product-canton.html	float64	50061.43402 - 171363.21609	-	-	11115	543
	Year of observation		int64	2017 - 2021	-	-	11115	0

References

Baier, N., Geissler, A., Bech, M., Bernstein, D., Cowling, T. E., Jackson, T., van Manen, J., Rudkjøbing, A., & Quentin, W. (2019). Emergency and urgent care systems in Australia, Denmark, England, France, Germany and the Netherlands - Analyzing organization, payment and reforms. *Health Policy*, *123*(1), 1–10. https://doi.org/10.1016/j.healthpol.2018.11.001

Postma, J., & Zuiderent-Jerak, T. (2017). Beyond Volume Indicators and Centralization: Toward a Broad Perspective on Policy for Improving Quality of Emergency Care. *Annals of Emergency Medicine*, *69*(6), 689-697.e1. https://doi.org/10.1016/j.annemergmed.2017.02.020