Enhancing Credit Analysis and Assessment using Geo Spatial Techniques

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A Practicum submitted to University College Dublin in part fulfilment of the requirements of the degree of M.Sc. in Business Analytics

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September, 2017

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Dedication

To X, Y and Z (typically family members)

Contents

List of Figures

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List of Algorithms

Foreword

Preface

> *Men occasionally stumble over the truth, but most of them pick themselves up and hurry off as if nothing had happened.*
>
> — Winston Churchill

Much of the front matter is optional. In particular, include things like a Dedication, List of Figures, List of Tables, List of Algorithms, only if there are enough of them to justify it and it would help the reader.

Don't include both a Foreword and a Preface since they perform similar roles.

The same goes for appendices, index, glossary, list of notation and terms at the end. Include if they would help the reader.

But always, of course, include the Bibliography.

University College Dublin
August 2, 2017

Xxxxx Xxxxxxx
Yyy Yyyyyyyyy

Acknowledgements

Abstract/Executive Summary

Chapter 1

Introduction

Here's an example of a quote.

> If anybody calls, says the brother, tell them I'm above in Merrion Square workin at the quateernyuns, says he, and take any message. There does be other lads in the same house doing sums with the brother. The brother does be teachin them sums. He does be puttin them right about the sums and the quateernyuns.
>
> *Indeed.*
>
> I do believe the brother's makin a good thing out of the sums and the quateernyuns. Your men couldn't offer him less than five bob an hour and I'm certain sure he gets his tea thrown in.
>
> *That is a desirable perquisite.*
>
> Because do you know, the brother won't starve. The brother looks after Number Wan. Matteradamn what he's at, it has to stop when the grubsteaks is on the table. The brother's very particular about that.
>
> *Your relative is versed in the science of living.*
>
> Begob the sums and the quateernyuns is quickly shoved aside when the alarm for grub is sounded and all hands is piped to the table. The brother thinks there's a time for everything.

— Myles na Gopaleen, *Cruiskeen Lawn*

1.1 Background

We begin by ...

1.1.1 Particular Background

Here are some examples of indexing: Newton's algorithm is still widely used, with modifications.

Note that the `\index{algorithm!Newton}` gives an index subentry for Newton under the entry for algorithm. The index entries and/or their page numbers can be formatted using a pipe | symbol in the `\index{}` command as follows:

Definition 1.1. The strictest definition of an *algorithm* is: a finite set of instructions that can be carried out in a finite amount of time: that is, it must terminate.

These instructions must be clear and unambiguous as they are to be interpreted by a (dumb) machine, so we must be absolutely precise about their meaning — mathematical logic is thus crucial in the design of algorithms.

In practice, many useful numerical "algorithms" that we study may get closer and closer to the desired solution without reaching it in a finite time. So, typically, we accept as an "algorithm" a finite set of instructions that will get within any desired tolerance of the true solution in a finite time. If the algorithm is stochastic (involves probability, as many modern ones do) the term "metaheuristic" is sometimes used.

In particular, you could use the `\index{algorithm@\textit{algorithm}}` or `\index{algorithm|\textbf}` to indicate the first or most important occurrence in the text of the term "algorithm", etc.

Some minor examples of other things indexing can do:

- You can handle accented words as in école: the index entry appears in the correct order under E, as desired;
- You can put in cross-references, as in

  Are metaheuristics really algorithms?

Note: when you LaTeX your file `myfile.tex`, a file `myfile.idx` is produced by `\makeindex`; this file must be sorted by an operating system command, e.g.,

```
makeindex myfile
```

This generated a *sorted* index file `myfile.ind`. Running LaTeX one more time gets the index printed in the right place by `\printindex`.

Here is a dummy theorem to show how to reference notation:

Theorem 1.2. *Let $\mathbb{F}_q$ be a finite field of q elements. Then q is a power of some prime number p.*

1.2 Referencing

Recall the strictures against plagiarism. Accidental plagiarism is still plagiarism. If you paraphrase, you must still cite. If your paraphrase is very similar to the original, then delete it and quote instead (and cite).

Use a reference format similar to that used in the journal Management Science. This can be achieved by using the Management Science Endnote style or by using a style based on the Chicago 15th B style in Endnote. Please ensure that volume (and issue numbers where appropriate) are displayed, as well as appropriate page numbers.

The following are examples of suitable output:

Keenan (2003) identified the role of GIS...

Or GIS can seen as a form of IS (Keenan, 2003) ...

Do not put the title of the paper you are citing, normally.

Do not write: (Keenan, 2003) found that...

To insert a citation, use the `\cite` command in LaTeX, or `\citep` and `\citen` etc. if you know `natbib`.

Chapter 2

Business Background

2.1 Introduction

We begin this chapter by ...

Chapter 3

Literature Review

3.1 Introduction

In recent years, purchasing capability of an **economy** has increased due to improvement in their finances, and employment levels. Ranging from buying small household items to **expensive items such as a house, a car or an office**. To buy a house or a car, one needs to have a large amount of money available to him; that is not necessarily possible most of the time.

Start with an exmaple to explain what is loan. There are certain critical circumstances that can occur anytime, where one may need a certain amount of cash. So one may need to borrow a generous amount of money from some other entity which is called a loan. A loan is lending a sum of money from one entity to another that involves repayment of the amount in near future. Lent amount is called principal amount and amount to be repaid is a summation of principal amount and an interest amount or other charges. It is not as easy as it sounds like, there are certain terms need to be agreed upon by each entity before exchange of the money. A loan can be for an amount taken at one time or can be taken in instalments Partial Payments]. A loan can be provided by banks, corporations and financial institutions. Banks and financial institutions provide various types of loans as per the need of an applicant, such as personal

loans, home loans, business loans, credit card loans and cash advances. There are times when the borrowing amount is very large and banks cannot provide the loan based on verbal agreement, they need to ensure that if an applicant is not able to repay the loan then they need to have a source to recover the lent amount. So, in this case, an applicant needs to apply for a mortgage with the bank.

A mortgage or collateral is an instrument that applicant has to pay back with predefined series of payments to the bank and financial institutions. Over a duration of time, an applicant needs to repay the loan inclusive of interest amount in order to free his/her mortgage. In case, if an applicant is not able to repay the loan within predetermined time, then the bank can recover their money by selling or putting it for auction the mortgage. The most common type of mortgage is residential mortgages were applicant gives his/her house to banks and in a case of no repayment then a bank will claim the house to recover the balance amount of the loan. This will give a bank a security that their lent amount is not at risk and over the years they will get back their lent money one way or the other. Mortgages come in various different forms. Most commonly used mortgage types are Fixed Rate Mortgage where applicant repays the loan amount on a fixed rate throughout the period determined and Adjustable Rate Mortgage where interest rate varies as per the changes in market interest rates. Our work is based on analysis of residential mortgages with varied interest types which will be discussed in later sections.

Put **Photo of loan application process folw chart**

Before analysing data based on residential mortgages, one needs to understand the process of giving a loan. Depending upon the requirement an applicant applies for a loan by filling an application form with all the necessary details required by the bank. Bank officials then analyse the application and may ask an applicant for additional information; after evaluation, bank approves or disapproves the loan. Next, borrower and bank sign an agreement that states all the terms and conditions of the loan including determined interest rate and

type of mortgage. Lastly, loan amount will disburse and borrower will start repaying the instalments that constitute principal amount and interest amount for predetermined period of time.

And, the major question is how do banks decide whether to give a loan or not? This question is of major concern as bank's cash flow highly depends on timely repayment of the loan. Every bank does not have the same procedure but majority of the loan review process is same. Following are few characteristics that bank officials will concentrate while evaluating a loan application:

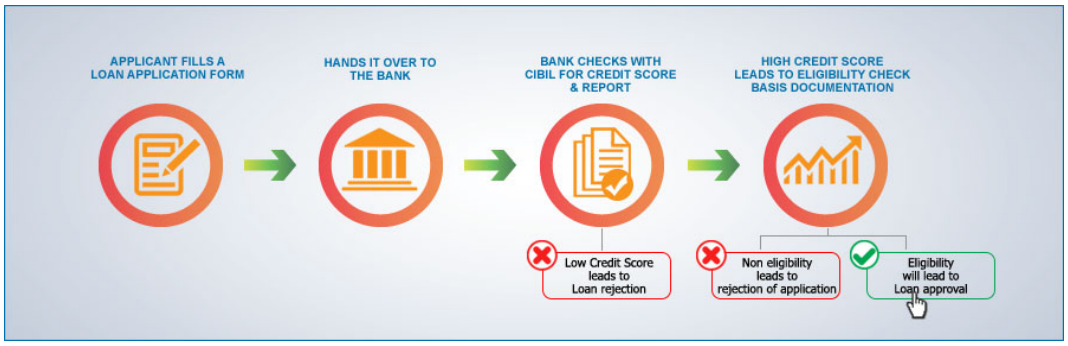
1. Credit history of applicant
2. Loan to Value ratio
3. Employment history
4. Character assessment of applicant
5. Evaluation of collateral
6. Financial statements such as bank history, cash flow, etc.

3.2 Credit Risk

Used to reduce the burden of bad debt on banks similar to bubble market crisi

3.3 Analysis and assessment of credit

Importance of assessing credit worthiness has been increased since, the property crash in 2008. Banks and Financial instituions making efforts to enhace tranditional credit scoring mechanisms by incorporating latest technology and tools. Not only avaiablity data about customer but also rapid development in machine learning and analytics providing a foundation stone to banks.



Traditional credit scoring process with random selection of good and bad portfolio from creditors file around 50 - 300 Capon (1982) chartartestics points from loan portfolios to build a essential subset to perform statastical analysis .

Three commonly used approaches used for selecting characterstics: Expert Knowledge, Stepwise Statstical procedure and evaulating individual characterstics. Subject Matter Expert(SME)

An applicant credit score is generated using credit rating system based on various charterstics points. Thereafter credit score is used depending on the usage of system. There are single cut-off and two cut-off stages in deciding application decision. In single cut-off, credit is granted if applicant score is higher than cut-off; otherwise credit is denied. Some instituations incorportae two stage cut-offs, in this system if credit score is higher than upper cut-off then credit is granted straighted and denied if score is lower thant lower cut-off. If score is between upper and lower cut-off then applicant credit history is pulled to calculate further scoring point and added to credit score. If new total score is higher than upper cut-off then credit is granted else denied.

Banks and financial instution sets their own cut-off for credit score based on the probablities of each applicant ability to repay or nonpayment of credit amount.

Adding flow chart of Evaulation Process and Pricing

However, Credit Risk has recevied a lot of critisim as well from Academics and Researchers. (Al Amari, 2002) has questioned about optimal method to

evaulate customers? What are key variables or data points which an analyst must consider while evaulating customer applications? On what basis one can classify an applicant as good or bad?

However, apart from above questions following can be useful when building a new credit scoring system. One should evaluate statistical techniques or algorithm by its accuracy to correctly classify historical portfolios into good or bad credit from creditors file. Also, Banks and Financial institution's identified factors that can influence the prediction of credit and loan quality by gathering all possible information from customer applications form, bank transactions history and previous credit history. Credit Analysts analysis of all these information to decide what all variables or characteristics to be included in final the credit model.

One of the principal objectives of credit scoring system is to assist Banks and Financial Institutions to streamline their credit management procedure and policy that will enable analysts with an efficient tool which will provide fast and accurate analysis of credit.On the longer run, such tool helps banks to avoid bad credit and scale up bank revenues and profit by selling more financial products to customers.

Diffrrerent Technology in Credit Risk:

Linear Regression

Discriminant analysis

Probit analysis

Decision trees

Expert systems

Neural networks

Genetic programming was introduced by Koza (1992)

Credit analysis and assessment is very important for banks and financial instituions to evaluate the credit worthiness of an applicant or a borrower. Banks

implements various factors while assessing credit risk; such as credit rating, loan to value ratio, probability of default, etc.; that leads to derivation of credit risk rating. Variety of financial techniques have been used by the officials to analyse credit risk.

3.3.1 Examples of citations

In (Atiyah, 1961, 1966b,a), Atiyah builds on the work of Adams (1962) to develop the foundations of topological K-theory. Lewis and McGarraghy (2000) and McGarraghy (2002) later extend parts of this to a previously unexplored algebraic setting.

Chapter 4

Methodology

Research is what I'm doing when I don't know what I'm doing.

— Werner von Braun

4.1 Introduction

The methodology used is ...

Chapter 5

Results

5.1 Introduction

The results ...

Chapter 6

Discussion

6.1 Introduction

In this chapter we examine ...

Chapter 7

Conclusions and Future Research

– That's a most foolhardy remark, he said sharply, because the nerve-strings and the sheep's head itself are whirling into the same bargain and you can cancel out one whirl against the other and there you are — like simplifying a division sum when you have fives above and below the bar.

– To say the truth I did not think of that.

– Mollycules is a very intricate theorem and can be worked out with algebra but you would want to take it by degrees with rulers and cosines and familiar other instruments and then at the wind-up not believe what you had proved at all. If that happened you would have to go over it till you got a place where you could believe your own facts and figures as exactly delineated from Hall and Knight's Algebra and then go on again from that particular place till you had the whole pancake properly believed and not have bits of it half-believed or a doubt in your head hurting you like when you lose the stud of your shirt in the middle of the bed.

— Flann O'Brien, *The Dalkey Archive*

7.1 Introduction

The significance of ...

Detailed tables

Xyz

Program code

Xyz etc

Glossary

Entries are listed in alphabetical order.

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List of Notation

Entries are listed in the order of appearance. The "Ref" is the number of the section, definition, etc., in which the notation is explained.

Symbol	Description	Ref
$\mathbb{F}_q$	Finite field of q elements	1.2

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