An Overview of Bank Marketing Forecast Based on Neural Networks

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Outline

- Introduction
- Objectives
- Methodology
- Conclusion

Introduction

Divided into the following details

- Applications of Neural Networks
- Opinions of supporters
- Opinions of opponents
- Research problem

Introduction

Applications of Neural Networks

- the system identification and control (vehicle control, process control, natural resources management)
- quantum chemistry
- game-playing and decision making (backgammon, chess, poker),
- pattern recognition (radar systems, face identification, object recognition and more
- sequence recognition (gesture, speech, handwritten text recognition), medical
- financial applications (e.g. automated trading systems)
- data mining (or knowledge discovery in databases, "KDD")
- visualization and e-mail spam filtering

From: http://en.wikipedia.org/wiki/Neural_network#Applications

Introduction

Supporters thought

- It is said that neural networks will become **an important tool in the commercial world and can create great value**, with new architectures, training rules and insights (Smith, 1999).

- Successful cases:

Law and Au (1999) proposed a supervised feed-forward neural network model to predict Japanese tourist arrivals in Hong Kong.

Kaefer et al. (2005) develops an alternative estimation approach for classifying new prospective consumers as “good" or “bad” prospects for direct marketing purposes.

Introduction

Opponents thought

- Kaastra and Boyd (1996) proposed that there are **few** organizations implemented neural networks successfully.

- Zahavi and Levin (1997) also proposed that it is difficult to train a successful model, because the expertise in the application domain and neural network theory are both needed. Thus, **neural net approach is not fit for target marketing**.

Introduction

Research problem

- Due to these arguments, the research problem of this paper is whether neural network is effective in bank marketing.
- Besides, how to train a satisfying neural network model in practical application will also be discussed.

Objectives

Divided into the following details

- Outline of problem
- Primary objective
- Contributions

Objectives

Outline of problem

- The data set was collected by a Portuguese banking institution for direct marketing campaigns.

- It is a classifying problem, which try to predict whether clients would subscribe a term deposit in the bank.

Objectives

Primary objective

- Try to train a neural network model for Bank Direct Marketing
- Argue whether neural network is effective in financial application
- Propose some suggestion for improving results in practical application

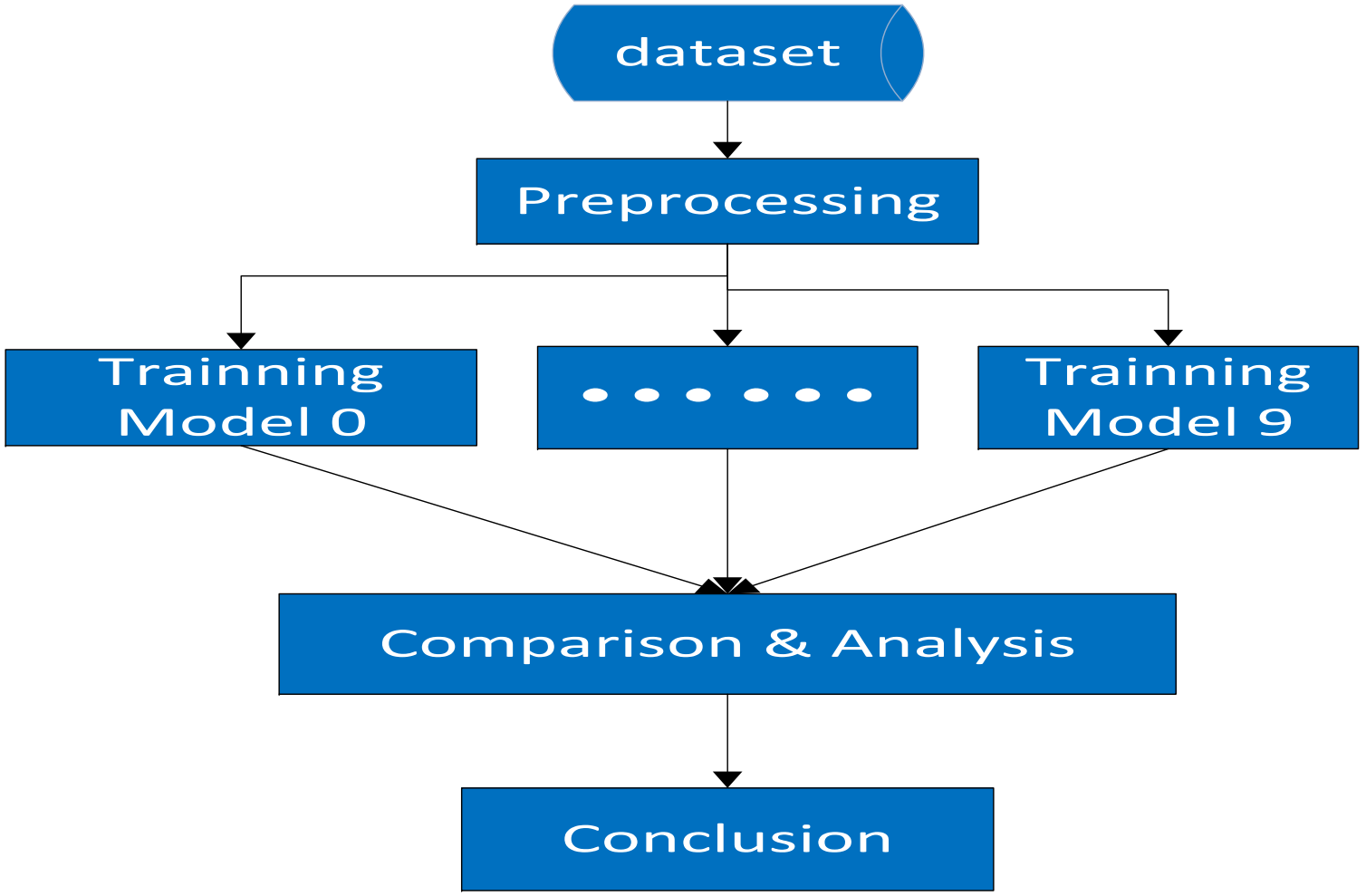
Objectives

Contributions

- Provide a practical model for bank marketing based on neural network
- Give reference values for similar applications
- Provided suggestion would help people who are lack of experience of applying neural network

Methodology

Process of experiment



Methodology—Data

Data Source

http://archive.ics.uci.edu/ml/datasets/Bank+Marketing

Composition

- Input：

  Instances: 45211

  Attributes: 16

- Output

  2 available results

Methodology—Preprocessing

1-out-of-N method encoding

- Changing **categorical** data into numerical data

Increase of positive class proportion

- Class-unbalance problem
- Do good to learn positive class feature

Methodology—Trainnig models

No.	Architecture
1	*original* Multilayer Feedforward Neural Network(*MFNN) basic model*
2	MFNN basic model—changing middle neurons' number
3	MFNN basic model—changing the output's number
4	MFNN basic model—changing the input variables.
5	MFNN basic model—changing the good class's proportion
6	MFNN – Ward Networks
7	MFNN – Multiple hidden slabs
8	PNN (Probalistic Neural Networks)
9	Unsupervised Architecture—Kohonen Architecture

Methodology—Comparison & Analysis

Evaluation tools—Precision and Recall

	Classified positive	Classified negative	
Classified negative	TP	FN	Recall rate(r)
Actual negative	FP	TN	
	Precision(p)		

$$p = \frac{TP}{TP + FP}$$

$$r = \frac{TP}{TP + FN}$$

TP: the number of correct classifications of the positive examples (true positive)
FN: the number of incorrect classifications of positive examples (false negative)
FP: the number of incorrect classifications of negative examples (false positive)
TN: the number of correct classifications of negative examples (true negative)

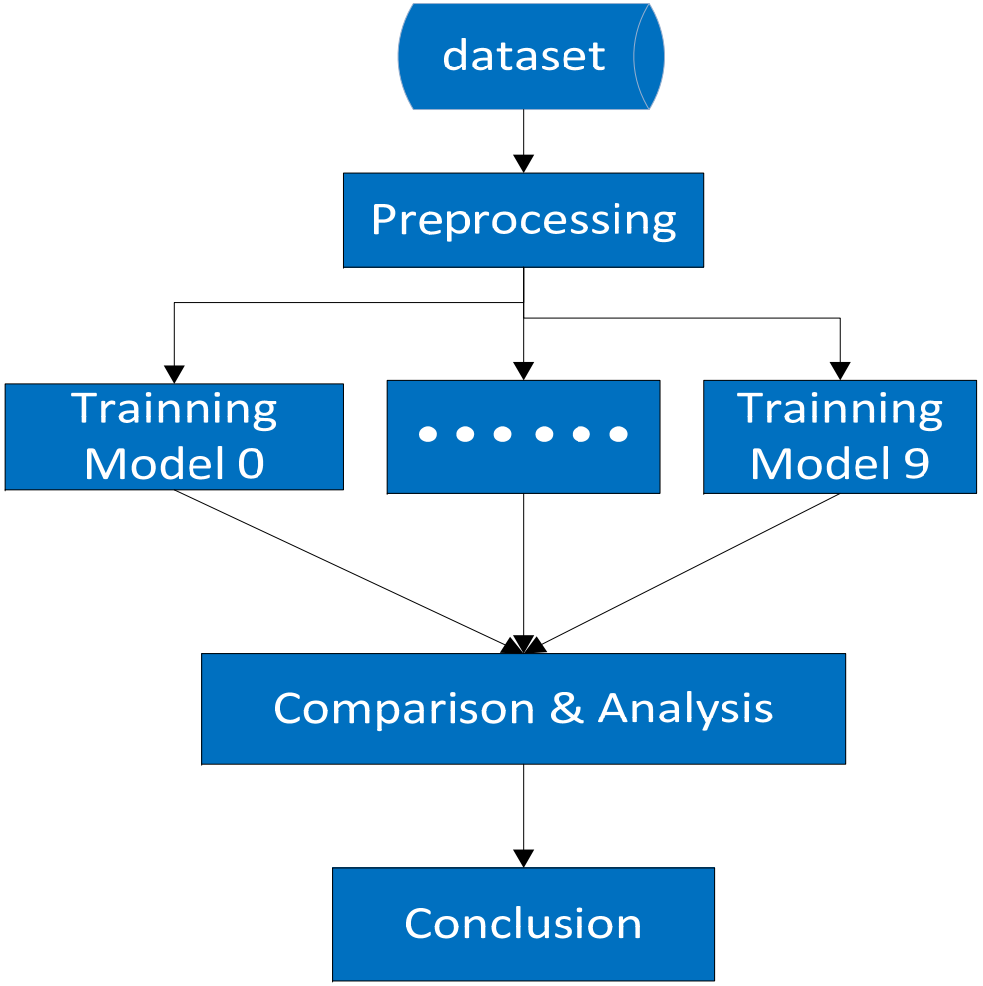
Methodology—Comparison & Analysis

Comparesion with original MFNN basic model

No.	Architecture	Effect
1	*original MFNN basic model*	\
2	MFNN basic model—changing middle neurons' number	Limited
3	MFNN basic model—changing the output's number	Limited
4	MFNN basic model—changing the input variables.	Limited
5	MFNN basic model—changing the good class's proportion	Improving Recall and precision obviously.
6	MFNN – Ward Networks	Improving Recall and precision obviously, but less than model 4
7	MFNN – Multiple hidden slabs	Decrease
8	PNN (Probalistic Neural Networks)	Precision improves with same recall rate
9	Unsupervised Architecture—Kohonen Architecture	Decrease obviously

Methodology—Comparison & Analysis

Three advices for using neuron network technology



- essential preprocess process
- multiple attempts of different models
- consideration for application's actual demands

Conclusion

This research demonstrates that neural network is a powerful tool in bank marketing, which would provide reference values for people applying neural network technology to address finical problem.

Refereces

Guresen, E., Kayakutlu, G., & Daim, T. U. (2011). Using artificial neural network models in stock market index prediction. Expert Systems with Applications, 38(8), 10389-10397.

Kaastra, I., & Boyd, M. (1996). Designing a neural network for forecasting financial and economic time series. Neurocomputing, 10(3), 215-236.

Kaefer, F., Heilman, C. M., & Ramenofsky, S. D. (2005). A neural network application to consumer classification to improve the timing of direct marketing activities. Computers & Operations Research, 32(10), 2595-2615.

Liu.B. (2006), Web Data Mining: Exploring Hyperlinks, Contents and Usage Data. Springer.

Law, R., & Au, N. (1999). A neural network model to forecast Japanese demand for travel to Hong Kong. Tourism Management, 20(1), 89-97.

Zahavi, J., & Levin, N. (1997). Applying neural computing to target marketing.Journal of Interactive Marketing, 11(1), 5-22.

Zhou, Z. H., & Liu, X. Y. (2006). Training cost-sensitive neural networks with methods addressing the class imbalance problem. Knowledge and Data Engineering, IEEE Transactions on, 18(1), 63-77.

Thanks

for your attention