



CELLULAR POSITIONING BY LOCATION FINGERPRINTING WITH THE AID OF PROPAGATION MODELS

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Abstract

The Fingerprinting method or the Database Correlation Method (DCM) is a network based positioning technique which has shown superior accuracy. DCM is based on a pre-measured database of location dependent variables such as Received Signal Strength (RSS). The major challenge of the technique is the effort involved in forming the database, which prevents it being deployed in large, dynamic networks.

The work presented in this thesis investigates the possibility of using network planning tool predictions instead of field measurements to create the fingerprint database for DCM. While the accuracy of this approach is lower than the DCM method with field measurements, further tuning of the predictions in order to improve the performance is proposed. The tuning method is defined as cell-wise calibration, which calibrates the predictions by using a lesser number of field measurements in a cell-by-cell basis. In addition, a novel fingerprint filtering approach and a fingerprint matching technique (a cost function) are proposed.

The trial results show that, the performance of DCM using the proposed database is inferior to that using a measured database. However, the application of calibration process for predictions improves the performance up to an acceptable level. The calibration method, designed for the bad urban scenario is based on curve fitting whereas that for urban, suburban and rural environments is based on neural networks. In addition, the novel fingerprint filtering approach is robust for the bad urban environment while the novel cost function shows higher performance with the proposed database.

The best positioning accuracy for the bad urban environment is 200m in 80% of the estimates and that for the urban environment is 125m (80%). Remarkable performance improvement can be observed in the rural environment giving a positioning error less than 385m in 80% of the estimates. The performance in



suburban environment is inferior to that-in both urban and rural, with an error less than 550m in 80% of the time.

The proposed solution for positioning is best suited for the deployment in large dynamic networks as a network-based method to provide basic information services, such as nearest ATM machine, petrol. station or hospital, traffic information and location based advertising.

The work presented in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

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CONTENTS

Declaration	ii
Abstract	iii
Dedication	iv
Acknowledgment	v
List of Figures	viii
List of Tables	xii
1 INTRODUCTION	1
1.1 Current status in the field of cellular positioning	1
1.2 LBS applications and Performance requirements	3
1.3 Motivation	4
1.4 Research Objectives and Contributions	5
1.5 Organization of the Thesis	6
2 LITERATURE REVIEW	7
2.1 Cellular Positioning	7
2.1.1 Positioning Parameters	8
2.1.2 Positioning Techniques	12
2.1.3 Performance Measures	14
2.2 Fingerprinting Method	17
2.2.1 Database Preparation	17
2.2.2 Location Estimation	18
2.2.3 Related Work	20
2.3 Radio Wave Propagation Models and Tools	21
2.3.1 Hata-Okumura Model	22
2.3.2 Walfisch-Ikegami Model	22
2.3.3 Outdoor & Outdoor-to-Indoor Coverage in urban at 1.8 GHz	23
2.3.4 CRC- Predict Propagation Model	23
2.4 Neural Network Techniques	24
2.4.1 The mathematical representation of a neuron	25
2.4.2 Neural Network Topology	26
2.4.3 Training a neural network	27
2.4.4 Neural Networks for Calibration	28
3 METHODOLOGY	29
3.1 Database Preparation	30
3.1.1 Predicted Database	31
3.1.2 Measured Database	33
3.2 Deviation Analysis	35
3.2.1 Cell-wise Analysis	35
3.2.2 Fingerprint-wise analysis	36
3.3 Positioning Algorithm	36
3.3.1 Fingerprint Filtering	36
3.3.2 Location Estimation	39
3.4 Calibration Process	43
3.4.1 Neural Network based Approach	45
3.4.2 Curve Fitting based Approach	52

4	TEST ENVIRONMENT	54
4.1	Measurement Setup	54
4.2	Urban area selection	56
4.3	Suburban area Selection	59
4.4	Rural are Selection	60
4.5	Analysis of RSS variation	62
4.5.1	Location-1- ENTC Balcony	62
4.5.2	Location-2 – University Front	63
4.5.3	Location-3	64
4.5.4	Impact on DCM Algorithm	64
5	RESULTS ANALYSIS	66
5.1	Deviation Analysis	67
5.1.1	Urban Environment	67
5.1.2	Suburban Environment	70
5.1.3	Rural Environment	72
5.2	Performance of DCM with Predicted Database	74
5.2.1	Urban	74
5.2.2	Suburban	78
5.2.3	Rural	80
5.3	Performance of DCM with Measured Database	82
5.3.1	Urban	83
5.3.2	Suburban	87
5.3.3	Rural	89
5.4	Performance Comparison using Predicted and Measured Databases	91
5.4.1	Urban	91
5.4.2	Suburban	93
5.4.3	Rural	94
5.5	Performance of different Calibration Techniques	95
5.5.1	Neural Network Techniques	96
5.5.2	Curve Fitting Techniques	100
5.5.3	Comparison of Curve Fitting & Neural Networks	104
5.6	Overall Performance Analysis	108
5.6.1	Urban	108
5.6.2	Suburban	111
5.6.3	Rural	112
5.6.4	Overall Results	113
6	CONCLUSION	116
6.1	Contributions	116
6.2	Trial Results	117
6.3	Commercialization Aspects	118
6.4	Future Work	118
	REFERENCES	120
	ABBREVIATIONS	125
	Appendix-A	
	Appendix-B	

LIST OF FIGURES

Figure	Page
1.1 Commercial LBS applications	3
2.1 Distance to MS from several BSs using propagation models	9
2.2 Angle of arrival parameter in GSM	9
2.3 Propagation Time measurement	11
2.4 TDOA parameter	11
2.5 Geometrical mean of all intersection points in geometrical method	13
2.6 Circular Error Probability	15
2.7 Cumulative Distribution Function	16
2.8 A Biological Neuron	24
2.9 Mathematical Representation of a Neuron	25
2.10 Mathematical Notation for Neural Networks	26
3.1 Summary of Methodology	29
3.2 Methodology for a selected environment	30
3.3 Methodology for interfacing to planning tool	31
3.4 Grid Translator Pro for PlanetEV	32
3.5 Format of the Fingerprint Database	33
3.6 Methodology of fingerprint creation for measured database	34
3.7 Far away estimation when filtering only by serving cell	37
3.8 Results using novel filtering approach	39
3.9 Significance of Cost Function-3	41
3.10 Different approaches of Positioning Algorithm	43
3.11 Approaches for calibration	44
3.12 Topology of Custom Neural Network-1	49
3.13 Topology of Custom Neural Network – 2	50
3.14 Curve fitting approaches	53
4.1 Complete measurement set up	54
4.2 Format of a measurement	55
4.3 RSS variation of a cell at a location over 10 measurements	55
4.4 Average signal strength variation at a location	56
4.5 RSS along Galle road in urban environment	57
4.6 RSS variation along Duplication road in urban environment	57

4.7	Predicted Fingerprints along roads in urban area	58
4.8	Measured Fingerprints along the roads in urban	58
4.9	Predicted & Measured Fingerprints in suburban	59
4.10	RSS variation of a cell in suburban area	60
4.11	Predicted and measured Fingerprints in suburban	61
4.12	RSS variation of a cell in rural area	61
4.13	Average RSS variation in different hours of day-1 at ENTC Balcony	62
4.14	Average RSS variation in different hours of day-2 at ENTC Balcony	63
4.15	Average RSS variation in different hours of the day at University front	63
4.16	Average RSS variation in different hours of the day-1 near IT office	64
4.17	Error for consecutive test measurements at one location within a day	65
5.1	Organization of the Presentation of Results	66
5.2	Signal Strength Comparison of a cell along Galle Road	68
5.3	RMSE plot for Fingerprints along Galle Road	68
5.4	RMSE Histogram of Fingerprints along Galle Road	69
5.5	RMSE plot of fingerprints along Duplication Road	70
5.6	RMSE Histogram of fingerprints along Duplication Road	70
5.7	Signal strength variation of a cell in suburban	71
5.8	RMSE plot of Fingerprints in suburban	71
5.9	RMSE histogram of Fingerprints in suburban	72
5.10	Signal strength variation of a cell in Rural	73
5.11	RMSE plot of Fingerprints in rural	73
5.12	RMSE histogram of Fingerprints in rural	73
5.13	Error CDF of Approach-A with Predicted Fingerprints- Galle Road	74
5.14	Error CDF of Approach-B with Predicted Fingerprints- Galle Road	75
5.15	Error comparison using predicted fingerprints- Galle Road	75
5.16	Error CDF of Approach-A with Predicted Fingerprints- Duplication Road	76
5.17	Error CDF of Approach-B with Predicted Fingerprints- Duplication Road	77
5.18	Error comparison using Predicted Fingerprints- Duplication Road	77
5.19	Error CDF of approach-A with predicted fingerprints – Suburban	78
5.20	Error CDF of approach-B with predicted fingerprints – Suburban	79
5.21	Error comparison using predicted fingerprints – Suburban	79
5.22	Error CDF of approach-A with predicted fingerprints – Rural	81
5.23	Error CDF of approach-B with predicted fingerprints – Rural	81

5.24	Error comparison using predicted fingerprints – Rural	82
5.25	Error CDF of approach-A with measured fingerprints – Galle road	83
5.26	Error CDF of approach-B with measured fingerprints – Galle road	83
5.27	Error comparison using measured fingerprints – Galle Road	84
5.28	Error CDF of approach-A with measured fingerprints – Duplication road	85
5.29	Error CDF of approach-B with measured fingerprints – Duplication road	85
5.30	Error comparison using measured fingerprints – Duplication road	86
5.31	Error CDF of approach-A with measured fingerprints – Suburban	87
5.32	Error CDF of approach-B with measured fingerprints – Suburban	87
5.33	Error comparison using measured fingerprints – Suburban	88
5.34	Error CDF of approach-A with measured fingerprints – Rural	89
5.35	Error CDF of approach-B with measured fingerprints – Rural	89
5.36	Error comparison using measured fingerprints – Rural	90
5.37	Error comparison using measured and predicted databases – Galle road	91
5.38	Error comparison using measured and predicted– Duplication road	92
5.39	Error comparison using measured and predicted – suburban	93
5.40	Error comparison using measured and predicted – Rural	94
5.41	Error CDF after calibration using different neural networks – Galle road	96
5.42	Performance comparison of neural network techniques –Galle road	96
5.43	Error CDF after calibration using neural networks – Duplication road	97
5.44	Performance comparison of neural network techniques – Duplication road	97
5.45	Error CDF after calibration using different neural networks – Suburban	98
5.46	Performance comparison of neural network techniques – Suburban	98
5.47	Error CDF after calibration using different neural networks – Rural	99
5.48	Performance comparison of neural network techniques – Rural	99
5.49	Error CDF after calibration using curve fitting methods – Galle road	100
5.50	Performance comparison of curve fitting techniques – Galle Road	101
5.51	Error CDF after calibration using curve fitting – Duplication road	101
5.52	Performance comparison of curve fitting methods – Duplication road	102
5.53	Error CDF after calibration using curve fitting methods – Suburban	102
5.54	Performance comparison of curve fitting methods - Suburban	103
5.55	Error CDF after calibration using curve fitting methods – Rural	103
5.56	Performance comparison of curve fitting methods - Rural	104
5.57	Performance comparison of curve fitting & neural networks– Galle road	104

5.58	Comparison of curve fitting & neural networks– Duplication road	105
5.59	Comparison of curve fitting & neural networks for calibration – Suburban	106
5.60	Comparison of curve fitting & neural networks for calibration – Rural	107
5.61	Overall results analysis – Galle road	109
5.62	Overall results analysis – Duplication road	110
5.63	Overall results analysis – Suburban	111
5.64	Overall results analysis – Rural	112
5.65	Plot of estimated locations of one test trial in four environments in maps	115



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LIST OF TABLES

Table	Page
1.1 FCC guidelines for location accuracy	2
1.2 Performance requirements of selected Location Based Applications	4
3.1 Score values and cost values of fingerprints	38
3.2 Characteristics of Cell-wise calibration and Fingerprint-wise calibration	45
4.1 Summary of fingerprints and test points in urban environment	58
4.2 Summary of fingerprints and test points in suburban environment	60
4.3 Summary of fingerprints and test points in rural environment	61
5.1 Cell-wise analysis – Galle Road	67
5.2 Cell-wise Analysis – Duplication Road	69
5.3 Cell-wise analysis – Suburban	71
5.4 Cell-wise Analysis – Rural	72
5.5 Results summary using predicted database	76
5.6 Results summary with predicted fingerprints – Duplication Road	78
5.7 Results summary with predicted fingerprints – Suburban	80
5.8 Results summary with predicted fingerprints – suburban	82
5.9 Results summary with measured fingerprints – Galle road	84
5.10 Results summary with measured fingerprints – Duplication road	86
5.11 Results summary with measured fingerprints – Suburban	88
5.12 Results summary with measure fingerprints – Rural	90
5.13 Comparison using measured and predicted fingerprints – Galle road	92
5.14 Comparison using measured and predicted fingerprints – Duplication road	93
5.15 Comparison using measured and predicted fingerprints – suburban	94
5.16 Comparison using predicted and measured fingerprints – Rural	95
5.17 Results summary of curve fitting & neural networks– Galle road	105

5.18	Results summary of curve fitting and neural networks– Duplication road	106
5.19	Results summary of curve fitting and neural networks – Suburban	107
5.20	Results summary of curve fitting and neural networks – Rural	108
5.21	Overall results summary – Galle road	109
5.22	Overall results summary – Duplication road	110
5.23	Overall results summary – Suburban	111
5.24	Overall results summary – Rural	112
5.25	Overall results of three environments	114
5.26	Results comparison with other results in literature	113
5.27	Comparison of current results and FYP results of three environments	115



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