ESTIMATION OF INTRA-SITE INTER-SECTOR COVERAGE OVERLAPPING USING USER DATA FOR LTE NETWORK

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DECLARATION

I declare that this is my own work and this Thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The supervisor should certify the Thesis with the following declaration.

The above candidate has carried out research for the Master of Science in Telecommunications Thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Kasun T. Hemachandra

Signature of the Supervisor: Date:

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ABSTRACT

The increase in user demand has created challenges for network capacity implementation. Due to the limited available LTE spectrum, capacity upgrades can take different directions such as adding new sites, new sectors, or using multi-beam antennas for cell splitting instead of adding new frequencies. However, the introduction of higher order sectorization has led to coverage overlaps and increased interference towards adjacent sectors, which limits the performance of Long term Evolution (LTE) networks and degrades spectral efficiency. Although resource scheduling methods have been introduced to cancel inter-cell interference, they limit resource utilization and impact network capacity.

Therefore, network operators need to minimize coverage overlap to an acceptable level to mitigate the negative impact on spectral efficiency. Physical optimization has played a key role in achieving this, but traditional methods of identifying inter-cell overlapping have been inefficient due to the lack of geographical view and the time taken to locate the actual issue. The introduction of minimization of drive test (MDT) has moved optimization activities to a data-driven perspective.

This thesis proposes a method of estimating intra-site inter-sector overlapping using MDT data and introduces three metrics to identify the granularity of the overlapping and its impact on Signal to interference and noise ratio (SINR) . These metrics can be used to prioritize the worst-affected sites and required azimuth changes to avoid overlapping. The proposed approach can overcome limitations such as false detection and time taken for identification in current methodologies. It accurately identifies issues with over 95% confidence, where spectrum efficiency can be improved, resulting in savings on network operating expenses.

Keywords: Inter-cell interference, Minimization of drive test, Coverage overlap, Signal to interference and noise artio, Spectral efficiency

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LIST OF ABBREVIATIONS

Abbreviation	Description
AISU	Antenna information sensor units
AOA	Angle of Arrival
BLER	block error rate
CAPEX	capital expenditures
CGI	cell global identity
CID	Cell ID
CQI	channel quality indicator
CRS	cell-specific reference signal
DL	downlink
EPC	evolved packet core
EUTRAN	evolved universal terrestrial radio access network
FDD	frequency division duplexing
GPS	Global Positioning System
HSS	home subscriber server
ICIC	Inter-cell interference coordination
ISI	inter-symbol interference
ISISC	Intra-Site Inter-Sector Co-Coverage Identification
KPI	Key Performance indicators
LTE	Long term Evolution
M-ISISC	MDT based Intra-Site Inter-Sector Co-Coverage Identification
MDT	minimization of drive test
MR	measurement report
OAM	operation and maintenance
OFDM	orthogonal frequency division multiplexing
OPEX	operating expenses
PCI	physical cell ID
PDSCH	Physical downlink shared channel
PMI	precoding matrix indicator
PS	packet switch
PSS	Primary synchronization signal
QOS	quality of service

Abbreviation	Description
RB	resource block
RE	resource element
RET	remote electrical tilt
RRU	remote radio unit
RSRP	reference signal received power
RSRQ	Reference signal received quality
RSS	Received Signal Strength
RSSI	Receive signal strength indicator
SINR	Signal to interference and noise ratio
SNR	signal to noise ratio
SON	self-organizing networks
SSS	secondary synchronization signal
TA	timing advance
TCE	trace collection entity
TDD	time division duplexing
TTI	transmission time interval

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