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Call History Analysis for Minimizing Expenditure on Mobile Recharge

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Abstract: *Mobile phones have become an essential part of modern life, and the number of users is increasing rapidly. Telecommunication companies offer various recharge plans based on customer usage patterns, making it difficult for users to select the most economical option. This study analyses the mobile call history of a user using statistical techniques to determine the most cost-effective recharge plan. The dataset consists of 87 days of call logs with 2,787 records extracted using the mobile application "Call History Excel." Summary statistics of outgoing calls, including number of calls and call duration, were computed to understand the user's calling behaviour. A total of 23 recharge plans were evaluated to estimate the expected monthly expenditure. The results show that selecting a plan based on actual usage can significantly reduce mobile expenses. The study also highlights the possibility of developing a mobile application for such analysis..*

Keywords: Mobile call history analysis; Recharge plan optimization; Statistical analysis; Mobile expenditure management; Call usage behaviour; Telecommunication data analysis.

I. INTRODUCTION

Mobile phones have become an essential part of modern life, and their use in daily communication has increased significantly over the past decade. The number of mobile phone users is growing rapidly due to the availability of affordable devices and telecommunication services. To expand their market, share and maximize profits, telecommunication companies offer a variety of recharge plans and special tariff prepaid vouchers designed according to customer usage behaviour. These plans differ in terms of call charges, validity period, and additional benefits such as free talk time or bundled services.

However, choosing the most appropriate recharge plan remains a challenge for many users because individual call usage patterns vary considerably. A plan that is beneficial for one user may not be economical for another. For example, a plan offering "27500 local/national seconds on recharge of Rs.199 for 28 days" may be advantageous only if the user's call usage matches the conditions of the plan. Therefore, an economical user aims to reduce the cost of mobile services by selecting a recharge plan that best fits their calling behaviour. Understanding how a user utilizes mobile calling services is essential for making an informed decision about the most suitable plan.

Call history analysis provides valuable insights into a user's calling behaviour, including call frequency, call duration, and frequently contacted numbers. By applying statistical techniques to call log data, it is possible to summarize call usage patterns and estimate the expected expenditure under different recharge plans. Such analysis helps users identify the plan that minimizes their mobile communication costs while meeting their usage requirements.

In this study, mobile call history is analysed from a customer's perspective using statistical methods. The objective is to examine the calling behaviour of a user, evaluate the suitability of multiple recharge plans, and identify the most economical option. A total of 23 recharge plans are compared for a single user, and a systematic approach is proposed to determine the most appropriate plan for minimizing expenditure on mobile recharge.

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II. THE PROBLEM OF STUDY

With the increasing number of mobile recharge plans offered by telecommunication companies, users often find it difficult to select the most economical plan according to their calling behaviour. Different plans provide various combinations of call rates, validity periods, and benefits, making the decision complex for an average user.

The problem addressed in this study is to analyse the mobile call history of a user in order to understand the pattern of call usage and estimate the monthly expenditure on mobile phone calls. Based on this analysis, an appropriate recharge plan that minimizes the monthly mobile expenditure can be identified. In addition, the study also aims to determine the break-even point for selected recharge plans to understand the minimum usage level required for a plan to become beneficial for the user.

Objectives:

The main objectives of this study are:

- To provide summary statistics of the mobile call usages which help to choose suitable recharge plan
- To rank service providers and contacts according to call duration
- To analyse the various tariff plans and recommend the most economical plan for the user.

III. LITERATURE REVIEW

Mobile call data analysis has gained considerable attention due to its ability to provide insights into communication behaviour, usage patterns, and telecommunication services. Call log data can help understand user behaviour and support decision-making in service optimization.

Adinarayana and Rao (2016) analyzed mobile call log data to recommend suitable mobile plans for users based on their calling patterns and peak-time usage. Their study showed that call history analysis can assist users in selecting cost-effective tariff plans. Eagle and Pentland (2006) examined large-scale mobile communication data to study social networks and communication structures. Similarly, Onnela and Barabási (2007) analyzed mobile communication networks to understand the strength and dynamics of human interactions. Blondel and Decuyper (2015) highlighted the potential of mobile phone datasets for behavioral and socio-economic analysis, while Calabrese and Ratti (2010) demonstrated the usefulness of mobile phone data in analyzing human mobility and urban activity patterns.

Although previous studies have extensively used mobile call data for behavioral and network analysis, limited research has focused on analyzing individual call history to identify the most economical recharge plan. The present study addresses this gap by applying statistical techniques to analyze call usage patterns and recommend a cost-effective mobile recharge plan.

Data:

The mobile call history of an idea user is used for this study. Mobile call history is extracted by using a mobile application named "*Call History Excel*" *(BRYCEN Co., Ltd)*. This application saves and exports the mobile call history available on your device to the Excel file. The dataset was prepared with data of 87 days' call log with 2787 entries which include parameters- Telephone Number, Name, Start date and time, Finish date and time, Talk Time, Type of call. Four additional parameters *Talk Time Seconds, Talk Time Minutes, Service Provider, Circle* also included.

IV. METHODOLOGY

Table 1.1 average of no. of calls and Call Duration (in sec) per day

Call type	Average number of calls per day	Average call duration (in sec) per day
Incoming	11.74	1033.23 (17.22 min)
Outgoing	09.47	0887.05 (14.78 min)
Missed	04.46	--
Total	25.67	1920.29 (32.00 min)

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Table 1.1 represent average no. of calls and call duration (in second) per day. Table 1.2 represent summary statistics of outgoing calls (in second) per day. These statistics help estimate the average monthly call usage, which is useful when evaluating different recharge plans.

Table 1.2. Summary statistics of outgoing calls per day

			Mean	StDev	Min	Max
Total		#of calls	9.47	5.12	2	37
		Call duration (*in Min*)	20.13	12.49	3	69
		Call duration (*in sec)*	887.10	679.1	50	3729
Local/STD	Local	#of calls	9.09	4.96	2	34
		Call duration (*in Min*)	19.31	12.4	3	69
		Call duration (*in sec)*	851.10	674	50	3729
	STD	#of calls	0.38	0.82	0	5
		Call duration (*in Min*)	0.82	1.7	0	7
		Call duration (*in sec)*	35.95	84.11	0	398
Idea to idea/other	IDEA	#of calls	3.50	2.3	0	13
		Call duration (*in Min*)	8.00	6.9	0	34
		Call duration (*in sec)*	356.50	382.1	0	1800
	Other	#of calls	5.90	3.8	1	27
		Call duration (*in Min*)	12.10	10.1	1	61
		Call duration (*in sec)*	530.60	547.5	15	3344

Table 1.3. 6% contacts- 50% usage

Order	Contact (distinct contacts 206)	Provider	Number of calls	Call duration (*in min*)	Call duration (*in sec)*	%	Cum. %
1	Contact No-1	ID	34	158	8482	10.99	10.99
2	Contact No-2	AT	12	129	7421	9.62	20.61
3	Contact No-3	ID	26	100	5275	6.84	27.44
4	Contact No-4	ID	35	104	5148	6.67	34.11
5	Contact No-5	ID	12	55	2908	3.77	37.88
6	Contact No-6	ID	8	40	2175	2.82	40.70
7	Contact No-7	VF	3	28	1610	2.09	42.79
8	Contact No-8	ID	63	70	1404	1.82	44.60
9	Contact No-9	AT	3	23	1271	1.65	46.25
10	Contact No-10	RG	31	36	1108	1.44	47.69
11	Contact No-11	AT	3	18	1029	1.33	49.02
12	Contact No-12	AT	7	18	950	1.23	50.25

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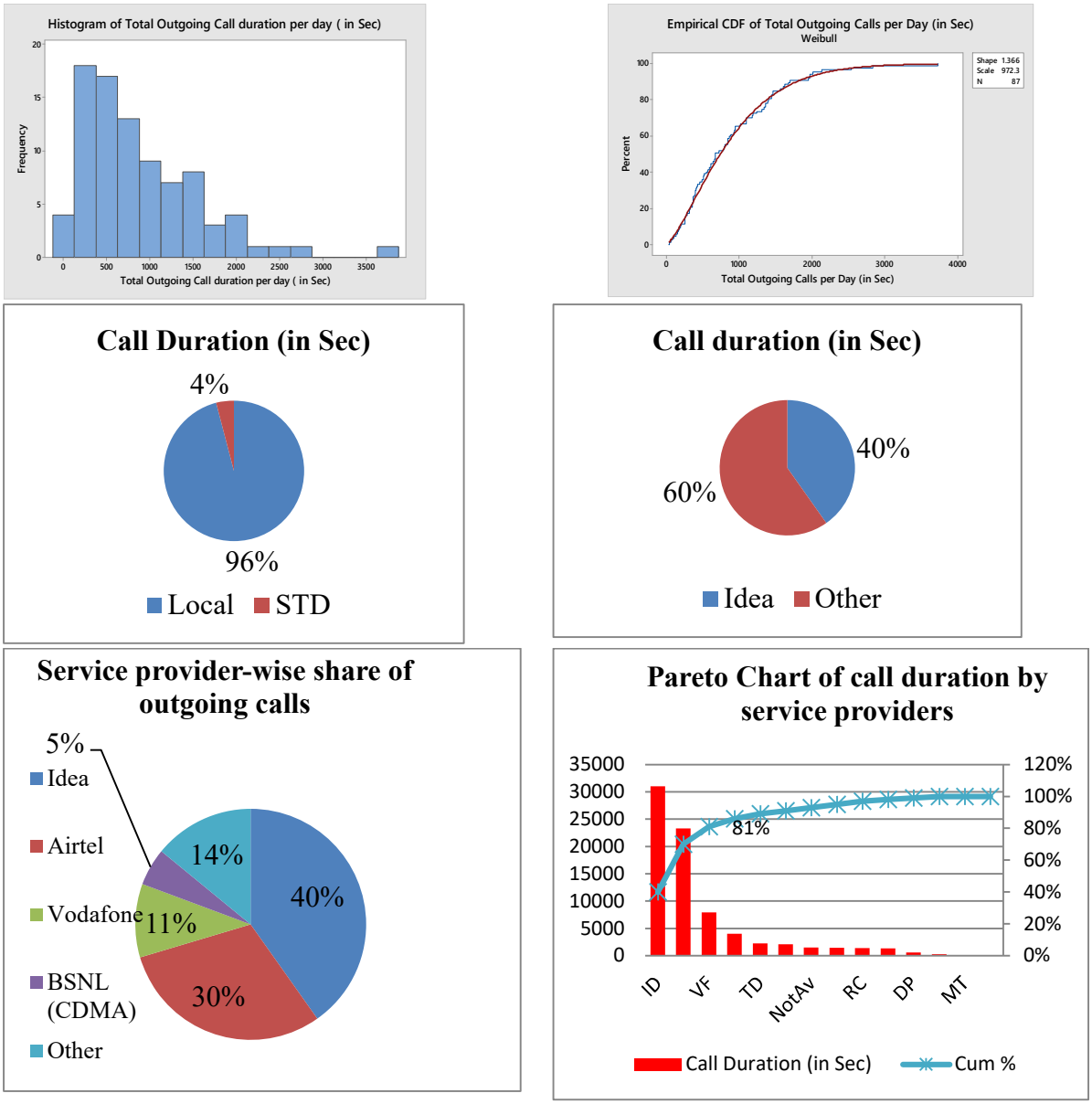
During the study period, the user contacted 206 different numbers. However, a small number of contacts contributed to a large portion of the total call duration. It was observed that 12 contacts (approximately 6%) contributed nearly 50% of the total call duration see Table 1.3.

Therefore, managing call expenditure for these frequently contacted numbers can significantly reduce overall costs.

Fig. 1.1 Distribution of per day outgoing call duration (in Sec)



Calls were made to 14 different service providers. Pareto analysis showed that three service providers (Idea, Airtel, and Vodafone) accounted for nearly 80% of the total outgoing call duration see figure 1.1. This information is useful for selecting recharge plans that offer lower charges for these service providers.

Plan Evaluation:

In order to determine the optimal recharge plan, 23 different recharge plans were evaluated.

For each recharge plan:

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The call charges were applied to the user's call usage data.
The expected monthly expenditure was calculated.
The break-even point was calculated. The break-even point represents the minimum call usage required for the user to benefit from that particular plan.
This helps determine whether a plan is suitable for a user based on their actual usage pattern.

Type	MRP	Tariff	Validity (in days)	Breakeven point	N	Average expenditure for 30 days
Regular		All mobile calls @1.6p/sec			58	395.05
1	9	Local Mobile Calls @30p/min	3	14	85	278.52
	18	All Local Calls @ 1p/sec	2	3000	86	541.9
	18	**Local Mobile Calls@30p/min**	**28**	**27**	**60**	**197.56**
	26	All Local Mobile calls@ 1p/sec	28	4333	60	281.53
	49	All Local Mobile @ 1p/sec	60	8167	28	278.18
	66	All Local Mobile calls @ 1.6p/2sec	28	2063	60	277.10
	92	All Local Mobile calls @ 30p/min	28	139	60	276.85
2	17	Local + STD@1p/sec	28	2833	60	265.44
	31	Local STD+ Mobile calls@1p/sec	28	5167	60	280.44
	34	**Local + STD calls @ 30p/min**	**28**	**52**	**60**	**204.54**
3	39	STD Mobile Calls@ 40 p/m	28	70	60	429.52
4	119	All Local IDEA to IDEA calls at 15p/min	28	147	60	401.97
5	19	3000 Local + STD Seconds.	3	1188	85	245
	29	5000 Local + STD Seconds.	5	1813	83	217.5
	54	4000 Local + STD Mobile Secs	5	3375	83	404.6
	99	15000 Local + National seconds	28	6188	60	244.48
	149	20000 Local + National seconds	28	9313	60	213.98
	104	300 Local + National Minutes	28	6500	60	340.8
	199	30000 Local + National Seconds	28	12438	60	216.59
6	19	30 STD MINS	3	20	85	596.7
7	14	1200 Local Mobile Seconds	2	875	86	383.6
	204	22000 Local Mobile Seconds	28	12705	60	260.91

V. SUMMARY AND CONCLUSION

In this study, the mobile call history of a single user was analysed to understand the user's calling behaviour and to identify a cost-effective mobile recharge plan. Summary statistics of outgoing calls were computed, including the total

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number of calls, call duration in seconds, and call duration in minutes. These statistics provided useful insights into the user's call usage pattern, which is essential for selecting an appropriate recharge plan.

A total of 23 different recharge plans were evaluated, and the expected monthly expenditure under each plan was estimated based on the user's call usage. The comparative analysis helped identify the most economical plan for the user. The results indicate that the plan "Local Mobile Calls @30p/min on recharge of Rs.18 for 28 days" is the most suitable option for the user under study. By adopting this plan, the estimated expenditure for 30 days is approximately Rs.198, which is significantly lower than the expenditure under the regular plan (Rs.395). Thus, the analysis demonstrates that selecting a recharge plan based on actual usage patterns can reduce mobile communication costs by nearly 50%.

Future scope:

The present study can be extended by developing a mobile application that automatically analyses call history and suggests suitable recharge plans to users. Such an application could provide several useful features, including:

Storing the call history of a large number of calls (for example, up to 10,000 records).

Displaying summary statistics of call usage based on the stored call history.

Allowing users to enter details of different recharge plans and estimating the expected monthly expenditure for each plan.

Furthermore, the scope of the study can be expanded to include mobile internet usage analysis, enabling users to optimize both call and data expenses. This would make the proposed approach beneficial for a wide range of mobile users.

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