Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 10, pp.7791-7794, October, 2019

DOI: https://doi.org/10.24941/ijcr.36954.10.2019

ISSN: 0975-833X

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

REVIEW ARTICLE

PREDICTIVE MODEL FOR NEXT CHANNEL REQUEST IN IPTV SYSTEMS FOR MINIMIZING CHANNEL SWITCHING DELAY

***Muhammad Ishtiaq, Umar and Muhammad Ali and Ihsan Ullah**

Department of Computer Science& Information Technology, University of Balochistan, Quetta, Pakistan

ARTICLE INFO

Article History:
Received 14th July, 2019
Received in revised form
18th August, 2019
Accepted 05th September, 2019
Published online 30th October, 2019

Key Words:
Corporate Governance,
Transparency, Accountability,
Commitment, Performance, Banks.

ABSTRACT

Internet Protocol Television (IPTV) provides live TV channels to users over IP in the form of streaming. Since each channel is transmitted on request, there is always the problem of delay between channel changes. The channel switching delay is familiar problem in digital television and widely researched in the context of IPTV systems. Several solutions have been proposed to reduce this delay. A few popular solutions suggest transmitting more than one channel to users at the same time. However, choosing these channels is not trivial as the next channel a user will switch to is not known. In this paper, we analyze machine learning approaches to predict the next channel of the user. Such a prediction can be useful in design of frameworks for reducing the channel switching delay. We have performed our experiments on dataset collected from an operational system on which the Multilayer Perceptron(MLP) model produces better accuracy.

***Citation: Muhammad Ishtiaq, Umar and Muhammad Ali and Ihsan Ullah.* 2018.** "Predictive Model for Next Channel Request in IPTV Systems for Minimizing Channel Switching Delay.", *International Journal of Current Research*, 11, (10), 7791-7794.

INTRODUCTION

In early days of Internet, delivery of high-quality entertainment contents was not possible due to low bandwidth. With the advancement in communication technologies and data compression techniques, it has become possible to deliver high quality contents over Internet. IPTV (Internet Protocol Television) is emerging as an alternative of traditional cable and broadcast systems. IPTV systems offers variety of television services with the help of Internet protocol suite on packet-switched network. From the IPTV user's point of view, IPTV is a system receiving TV programs as streams (downloaded and played almost simultaneously) over Internet connection, instead as broadcast signals from the antenna, satellite dish, or fiber optic cable. IPTV is gaining popularity by offering variety of programs to users. In IPTV systems all channels cannot be transmitted simultaneously due to lack of network bandwidth. Therefore, only a small portion of requested program by end user is available at STB. When user selects a new channel, delay arises and this delay is called channel zapping time or channel switching delay. Channel zapping time is defined as the time difference between the user request for a channel change by pressing some buttons on the remote control and the display of the first frame of the requested channel on the TV screen.

***Corresponding author:* Muhammad Ishtiaq,**
Department of Computer Science& Information Technology, University of Balochistan, Quetta, Pakistan.

Channel switching delay which can be up to two seconds or more is the main concern in providing services through IPTV. This delay should be below 430 ms (Fernando M. V. Ramos, 2010) for an acceptable quality of experience (QoE). How to reduce or minimize this delay is the biggest challenge for IPTV providers. Channel zapping time is the critical issue in IPTV service system. Several techniques were proposed to reduce this channel zap time. The aim of this article is to provide a survey of different channel switching schemes and analysis of different models for fast channel prediction for IPTV systems.

Background and Related Work: As users expect to switch the channels quickly, startup delays in IPTV must be reduced to just a few milliseconds or even microeconds. Major concern in IPTV based networks is to transmit the channels from IPTV service providers to end user with high speed and less zapping time (switching delay). Total switching delay is a sum of several delays (Toshiaki Ako, 2010). These are Network Delay, Synchronization Delay, Buffering Delay and STB processing Delay. Network delay is the delay which user experiences to leave the current channel and join the new channel and access link propagation delay. Total of this delay is usually below 100-200ms. Network delay does not contribute much to overall delay. STB processing delay does not contribute much and it is relatively low usually below 50ms. Major contributors to channel change delay are then

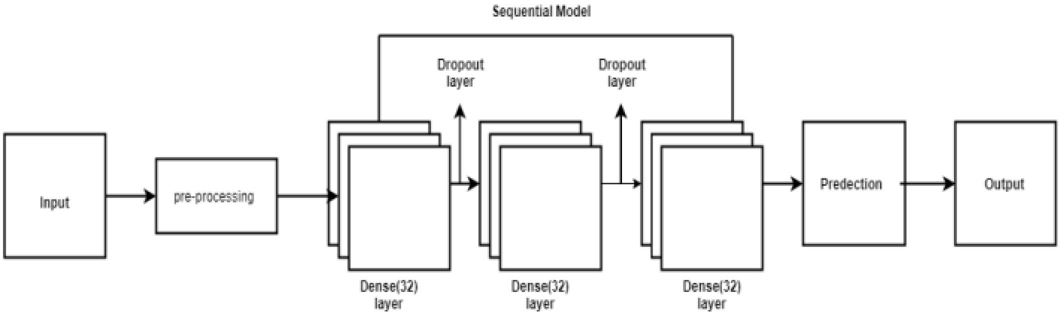

Figure 1. Block Diagram of Sequential Model

uid	main_uid	starttime	stoptime	pg_startp	pg_starttime	pg_stoptime	md_durat	mac	ip	type	channel	ch_id	pg	md_ty	rc_id
2	905373	11/9/2011 7:30	11/9/2011 7:38	2011-11-0	11/9/2011 6:00	11/9/2011 9:15	PT3H15M	752232a6f	46bbf3db	0	bbcone	120	breakfast	0	
3	905618	11/9/2011 8:10	11/9/2011 8:19	2011-11-0	11/9/2011 6:00	11/9/2011 9:15	PT3H15M	752232a6f	46bbf3db	0	bbcone	120	breakfast	0	
4	906294	11/9/2011 9:45	11/9/2011 9:53	2011-11-0	11/9/2011 9:15	11/9/2011 10:00	PT0H45M	752232a6f	46bbf3db	0	bbcone	120	remembra	0	
5	907706	11/9/2011 12:12	11/9/2011 12:12	2011-11-0	11/9/2011 11:45	11/9/2011 12:15	PT0H30M	752232a6f	46bbf3db	0	bbcone	120	cash in th	0	
6	910207	11/9/2011 15:30	11/9/2011 15:41	2011-11-0	11/9/2011 15:05	11/9/2011 15:35	PT0H30M	752232a6f	46bbf3db	0	bbcone	120	junior bak	0	
7	910207	11/9/2011 15:30	11/9/2011 15:41	2011-11-0	11/9/2011 15:35	11/9/2011 16:00	PT0H25M	752232a6f	46bbf3db	0	bbcone	120	prank patr	0	
8	910253	11/9/2011 15:43	11/9/2011 15:43	2011-11-0	11/9/2011 15:35	11/9/2011 16:00	PT0H25M	752232a6f	46bbf3db	0	bbcone	120	prank patr	0	
9	910607	11/9/2011 16:10	11/9/2011 16:10	2011-11-0	11/9/2011 16:00	11/9/2011 16:30	PT0H30M	752232a6f	46bbf3db	0	bbcone	120	roy	0	
10	910843	11/9/2011 16:25	11/9/2011 16:25	2011-11-0	11/9/2011 16:00	11/9/2011 16:30	PT0H30M	752232a6f	46bbf3db	0	bbcone	120	roy	0	
11	911230	11/9/2011 16:42	11/9/2011 16:48	2011-11-0	11/9/2011 16:30	11/9/2011 17:00	PT0H30M	752232a6f	46bbf3db	0	bbcone	120	serious ex	0	
12	1335169	12/12/2011 13:27	12/12/2011 13:27	2011-12-1	12/10/2011 22:20	12/10/2011 23:53	PT1H33M	b46f7bba	27050f43b	1	bbcone	120	match of t	0	176688
13	1439841	12/13/2011 23:25	12/14/2011 0:15	2011-12-0	12/9/2011 18:00	12/9/2011 18:38	PT0H38M	b46f7bba	27050f43b	1	channel4	122	the simps	0	176101
14	1448199	12/14/2011 15:16	12/14/2011 15:41	2011-12-1	12/12/2011 18:00	12/12/2011 18:38	PT0H38M	b46f7bba	27050f43b	1	channel4	122	the simps	0	177590
15	1448383	12/14/2011 15:41	12/14/2011 15:55	2011-12-1	12/11/2011 16:20	12/11/2011 16:58	PT0H38M	b46f7bba	27050f43b	1	channel4	122	t4: the sin	0	177054

Figure 2. Snapshot of Dataset

synchronization of video stream and buffering of stream, adding up to 1 or 2 second on average. Network delays occur during exchange of signaling messages and processing time to set up network state at each node.

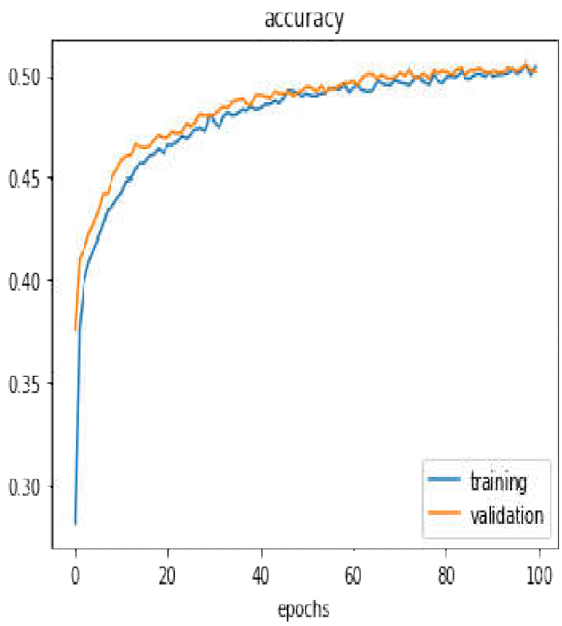

Figure 3. Accuracy graph

After defining the switching delay, now we focus on related work on fast channel switching schemes proposed to minimize the channel zapping time. An approach aims at minimizing the switching delay through providing lower quality stream in the startup (B. Dekeris, 2010). It proposes that if the user changes the channel and viewing time is less than 1 minute, the low quality video from IPTV systems is sent to user. After a lapse of 1 minute, transmission of high quality video begins.

Employing equipment like proxy servers in IP networks may also reduce the switching delay (Fonseca,2013). Several approaches based on transmitting redundant channels have been proposed which vary in the selection of the transmitted channels. We discuss a few representatives of them. An approach based on linear switching is proposed by Chen et al. (Yu-Wei Chen, 2012)where linear switching means that a user switches channels one after the other by pressing the button of remote controller up or down.

It is assumed that if the user does not switch linearly, the jumping distance is usually very small. It is most likely that user switch to one of the neighboring channels. Based on this, scheme is proposed to send the adjacent channels to the Set Top Box (STB) with the requested channels simultaneously during switching period. These channels are synchronized and buffered with the requested channel. If the user switches to these channels then switching delay experienced by the user is almost zero. However, channel switches are not always linear.

By contrast, anon-linear switching approach is proposed by Zandiabasabadi et al. (Zahra Zandiabasabadi, 2012). In this approach random channels in addition to adjacent channels are pre-joined with the requested one. Expected random channels are provided by the rating server which maintains data and information of all channel switching requests received from all STBs. This approach requires a large bandwidth and again random channels are chosen from the overall popularity. Another approach attempts to get it closer to the end user by selecting adjacent channels and those who were recently visited by the user are transmitted redundantly (Abdol Agheli Khosroshahi, 2016 and Eunji Lee, 2009). Another similar approach is proposed to recommend channels to viewers (CAN YANG, 2018). However, this type of system is used as recommender system to minimize the searching time of the viewer instead of minimizing the delay.

RESEARCH METHODOLOGY

In our approach, we propose to use machine learning for the prediction of the next channel. To do so, we investigate here the efficiency of machine learning algorithms on prediction of next channel. We first describe our model and then discuss experiments and results.

Proposed Model: In this section, we will discuss the sequential model proposed for prediction of next channel. Fig 1 represents the model in which data as input is fed as input to the layer known as input layer. After pre-processing, input is fed into dense layer to predict the output. Dense layers are assigned with weights and biases, after processing of input data into dense layers with some activation function, prediction of next channel as output is shown in the diagram.

Dataset: For our model, we use dataset of user statistics collected by Lancaster Living Lab (Yehia Elkhatib, 2014). Lancaster Living Lab is a small IPTV service provider of both live and on-demand high quality contents to users via set top boxes, PCs and mobile devices. The dataset of thousands of users is made available to researchers for developing better understanding of video delivery mechanisms, user behavior, and program popularity. From this infrastructure by Lab, a vast amount of deep statistics reported by user devices was collected. We present here a snapshot this dataset covering the period of October 2011 – April 2012 in Fig-2.

After cleaning the data we select four relevant fields as identified by (Ullah et al. 2012). These fields are Starttime, md_duration, mac_address and channel. Furthermore, 75% data (approx twenty thousand rows of dataset) were used to train the model. 25% data(approx 5 thousand rows of dataset) were used to validate /test the model after training the model.

Experiments and Results: For prediction of next channel most likely to be requested by the user, experiments were performed to test the efficiency of proposed model. LSTM (Long Short Term Memory) model was used which is a type of RNN (Recurrent Neural Networks) to predict the next channel. Accuracy was 0.2863, validation accuracy was found 0.257. But result/output was not satisfactory. In second experiment, Multilayer Perceptron (MLP) Model which is type of neural network used for better prediction. The result / accuracy achieved was still low. Accuracy was 0.30 and validation accuracy was 0.29857 which was still not satisfactory. In third experiment, as mentioned before, we use MLP model in which dense layers are used. We increase dataset fields from two to four and after normalizing the data ,we train the model and accuracy was 0.5052 and validation accuracy was 0.5028. We can further improve the accuracy of model by normalizing the data because right data in the right format is one of the major problem to solve in deep learning.

Conclusion & Future Work

Channel switching is a hot topic in video streaming systems. Several effort have been made to reduce the impact of channel switching on the performance. Predition of the next channel can improve these systems where the next channel may be pre-streamed. In our work, we tested several machine learning algorithms on a real streaming dataset. Our results have shown an accuracy up to 50%. These predictions can be utilised in the systems in a such a way to improve the performance. Such an example is that to stream a few channels to a user before the request and those channels be based on the predictions. In future, we are planning to test these algorithms on other datasets to head towards generalization. Furthermore, we will work to develop a complete framework to utilise machine learning for overall improvement of the performance.

REFERENCES

Abdol Agheli Khosroshahi, S. Y. 2016. IPTV channel switching delay reduction through predicting subscribers' bahaviors and preferences. *Multimed Tools Appl, 75*, 6283–6302.

Alireza Abdollahpouri 1 & ReyhanQavami 1 & Parham Moradi 1, On the synthetic dataset generation for iptv services based on user behavior

Aytac Azgin, Y. A. (n.d.). Channel Reordering with Time-shifted Streams to Improve Channel Change Latency in IPTV Networks. *IEEE*, 1-6.

Chae Young Lee, C. K. 2010. Reducing Channel Zapping Time in IPTV Based on User's Channel Selection Behaviors. *Ieee transactions on broadcasting, 56*(3), 321-330.

Chuan-Ching Sue, C.Y. H.-Y. 2016. A Fast channel zapping mechanism based on practical user's behavior prediction model for iptv service. *International Journal of Advanced Computer Technology (IJACT), 5*(1), 1-10.

Damodar Banodkar, K. R. 2008. Multicast Instant Channel Change in IPTV Systems. *IEEE*, 1-10.

Dekeris, B. L. N. 2010. IPTV Channel Zap Time Analysis. *Elektronika ir elektrotechnika, 106*(10), 117-120.

Eunji Lee, J. W. 2009. Popular Channel Concentration Schemes for Efficient Channel Navigation in Internet Protocol Television. *IEEE Transactions on Consumer Electronics, 55*(4), 1945-1949.

Fernando M. V. Ramos, P. R. 2010. Channel smurfing: Minimising channel switching delay in IPTV distribution networks., (pp. 1-7).

Fonseca, D. A. 2013. A Survey of Channel Switching Schemes for IPTV. *IEEE Communications Magazine*, 121-127.

Houwei Cao3, Qihu Yuan1, And Guoqiang Han 1, Personalized channel recommendation deep learning from a switch sequence

Lij Basicevic , *Senior Member, IEEE*, Dragan Kukolj, *Senior Member, IEEE*, Stanislav Ocovaj, GordanaCmiljanovic, and Nemanja Fimic , *Student Member, IEEE,* A fast channel change technique based on channel prediction

Mamun-Or-Rashid, D. S. 2008. A Channel Management Framework to Construct User Preferred Fast Channel Change Stream in IPTV. 462-465.

Meeyoung Cha, K. P. 2008. Channel Selection Problem in Live IPTV Systems. 495-496.

Mounir Sarni, B. H. 2009. A Novel Channel Switching Scenario in Multicast IPTV Networks. 396-401.

Mounir Sarni1, 2, Benoit Hilt1, and Pascal Lorenz1, A Novel channel switching scenario in multicast iptv networks

Pavol Kocan, J. M. 2010. Automated Channel Changing in IPTV. *10th Scientific Conference of Young Researchers – FEI TU of Košice*, (pp. 1-3).

Suman Kalyan Mandal, M. M. (n.d.). Intelligent Pre-fetching to Reduce Channel Switching Delay in IPTV Systems., (pp. 1-6).

Tein-Yaw Chung, C.-L. H.-Y.Y.-C. 2011. A Fast Channel Switching System for IPTV based on Multi-channel Preview. *Proc. of the 4th Annual International Conference on Computer Games, Multimedia and Allied Technology (CGAT 2011)*, (pp. 41-46).

Toshiaki Ako, H. N. 2010. Reducing the Channel Switching Delay in IP-based Multi-channel Streaming. *IEEE COMSOC MMTC E-Letter, 5*(5), 54-58.

Ullah I, Doyen G., Bonnet G. and Gaiti D. 2012. A Survey and Synthesis of User Behavior Measurements in P2P Streaming Systems. IEEE Communications Surveys & Tutorials, 14(3): 734-749.

Uz Uzunalioglu, H. 2009. Channel Change Delay in IPTV Systems. *2009 6th IEEE Consumer Communications and Networking Conference* (pp. 1-6). IEEE Conference Publications.

Xiaoyan Yin†, Yanjiao Chen‡□, Xiaoqian Mi†, Hua Wang†, Zhanyong Tang†, Chen He†, DingyiFang†,TIME context-Aware iptv program recommendation based on tensor learning

Yang 1, C. (Member, Ieee), Sixuan Ren1, Yong Liu2, (Fellow, Ieee),

Yehia Elkhatibl Dataset 2014. On usage of a live &VoD P2P IPTV Service, 14-th IEEE International Conference on Peer-to-Peer Computing, pp. 1-5.

Yun Gao_y, Xin Wei_y, GengxinZhang_y, Liang Zhou_y, and Zhenjiang Dongz, MINING IPTV USER BEHAVIORS WITH AN ENHANCED LDA MODEL, *College of elecommunications and Information Engineering*

Yu-Wei Chen, Y. T.T. C. 2012. Minimizing Zapping Time in IPTV Based on User's Interest. *International Journal of Computer and Communication Engineering, 1*(2), 77-80.

Zahra Zandiabasabadi, M. J. 2012. Measuring the delay in channel switching and its optimization in iptv networks by pre-joining method of tv channels. *International Journal of Engineering Sciences & Emerging Technologies, 4*(1), 1-14.

****