Utilisation of viewing statistics in video recording credits detection

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Bachelor's thesis presentation

April 14, 2022

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1. Introduction

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Problem & Solution

1. Detect where recorded TV programs actually start and end
2. by analysing patterns of user viewing behaviour

1. Introduction

The issue with recording TV programs:

▶ TV programs are not usually broadcasted exactly according to electronic program guide (EPG)

▶ Timing recording by EPG can lead to program being recorded only partially

▶ Buffer can be added to ensure that whole program is recorded

▶ Example recording of 10 o'clock news:

Buffer	10 o'clock news according to EPG	Buffer

21:58 22:00   22:20   22:24

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▶ Example recording of 10 o'clock news:

Surplus	10 o'clock news actual broadcast time	Surpuls

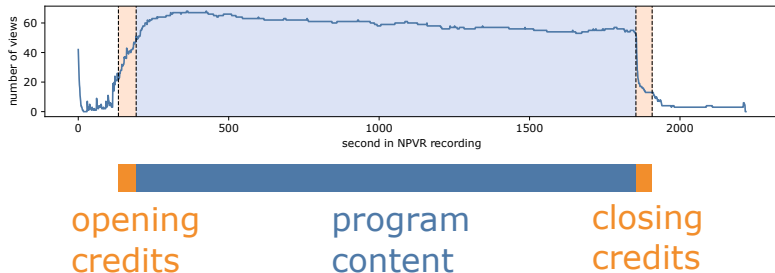21:58　　　22:01　　　　　　　　　　　　　　　　22:21　　　22:24
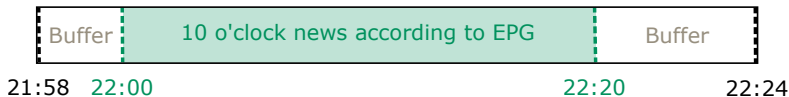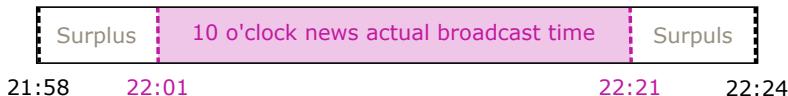
1. Introduction

- ▶ Goal: identify surplus content
- ▶ Why?
  - Its annoying to fast forward over surplus content
  - Surplus content consumes storage space

2. User viewing behaviour data

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Watched seconds of 100 views of a 37 min recording

opening
credits

program
content

closing
credits

▶ Could credits be detected solely with this data?

2. User viewing behaviour data

Where does the user behaviour data come from?

- ▶ The NPVR service provider company I am working for
- ▶ NPVR $\approx$ a normal video recorder
  - • but the TV programs you record are stored in a cloud server instead of a device in your home

2. User viewing behaviour data

Why is the data collected?

► To monitor the user experience quality

- smoothness of streaming etc.

- with data related to the above, it can be calculated which parts of a recording were watched during a view, and which parts were fast forwarded
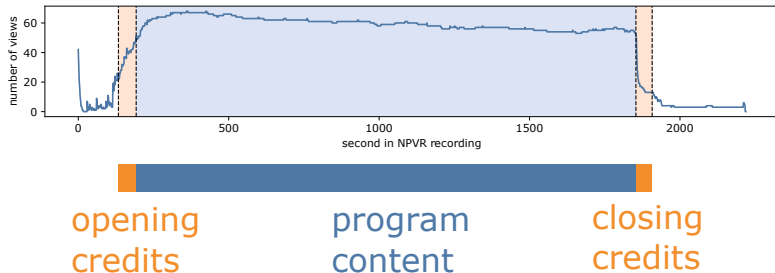
2. User viewing behaviour data

What the examined data actually is?

▶ For each view of any recording, it can be calculated which parts of the recording were watched during a view, and which parts were fast forwarded

▶ Users who record the same program will receive an identical recording

▶ User viewing behaviour data: sum of viewed parts for recordings of the same program

2. User viewing behaviour data
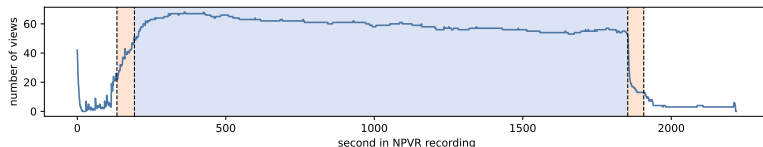
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3. Problem formulation and methods

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Goal and hypothesis

- ▶ Goal:
  identify where the viewer count changes drastically
- ▶ Hypothesis:
  major viewer count changes happen during the credits

3. Problem formulation and methods

Problem formulation

- ▶ Signal processing, offline change point detection
- ▶ Minimisation problem for the sum of costs of each segment (segments are divided by change points)
  - cost function
  - search method
- ▶ Python scientific library `ruptures` implements the above [1]

Cost function

2 1 2 4 5

$\sigma^2 = 2.7$

▶ cost function: variance, detects distribution mean shifts well

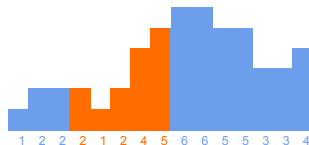# 3. Problem formulation and methods

Cost function

Search method

$\sigma^2 = 2.7$

▶ cost function: variance, detects distribution mean shifts well

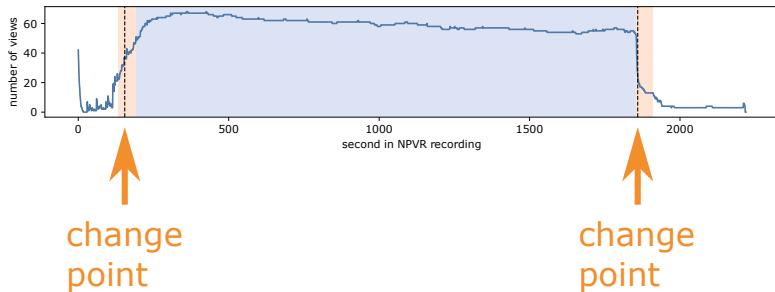▶ search method: dynamic programming, produces optimal segmentation

4. Results

4. Results

Typical output

4. Results

Predicted change point distance from closing credits start

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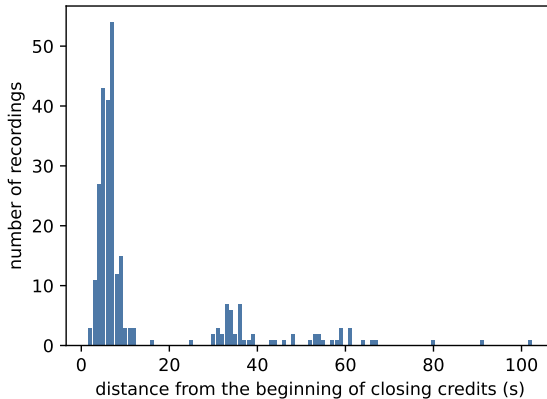
4. Results

Can credits be detected based solely on user viewing behaviour?

- ▶ Yes, for approximate location of credits
- ▶ No, for exact start or end of credits

More precise credits detection could perhaps be done by combining this with other methods

- ▶ For example optical characrer recognition (OCR), that identifies text in images

Thank you!

References

[1] Truong, C. & Oudre, L. & Vayatis, N. Selective review of offline change point detection methods. Signal Processing. 2020, vol. 167. P. 107299. Available at: doi:10.1016/j.sigpro.2019.107299.