Tracing Temporal Changes of Selection Criteria from Gaze Information

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Introduction

Motivation

Making decisions among alternatives is a fundamental part of people's daily lives. However, people sometimes only have a fuzzy understanding of their selection criteria (a set of some criteria for that decision).

We aim to trace the temporal changes of selection criteria from gaze information in order to design a concierge system that can assist users' decision making.

Problem

1. How to estimate users' selection criteria during a short period
2. How to decide appropriate window size for analysis

Approach

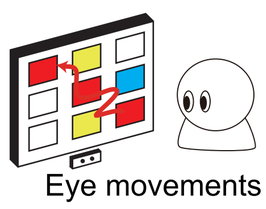
Propose the **multiscale exact test** to detect users' distinctive browsing behavior by its significance level to users' neutral browsing behavior

Multiscale exact test

Situation:
A user is browsing a digital catalog on a screen

Eye movements

Recoded gaze information is represented as a sequence of items (time *t* is decided by the transition of gaze targets)
⇒ An attribute-value sequence $\{v_t\}$ is obtained



Users' neutral browsing behavior

We assume that users look at items randomly when they are in neutral browsing, they are not focusing on any specific criteria (attribute value).

The multinomial parameters, how the attribute value *k* is looked at can be represented as $p_k = N_k / N$.

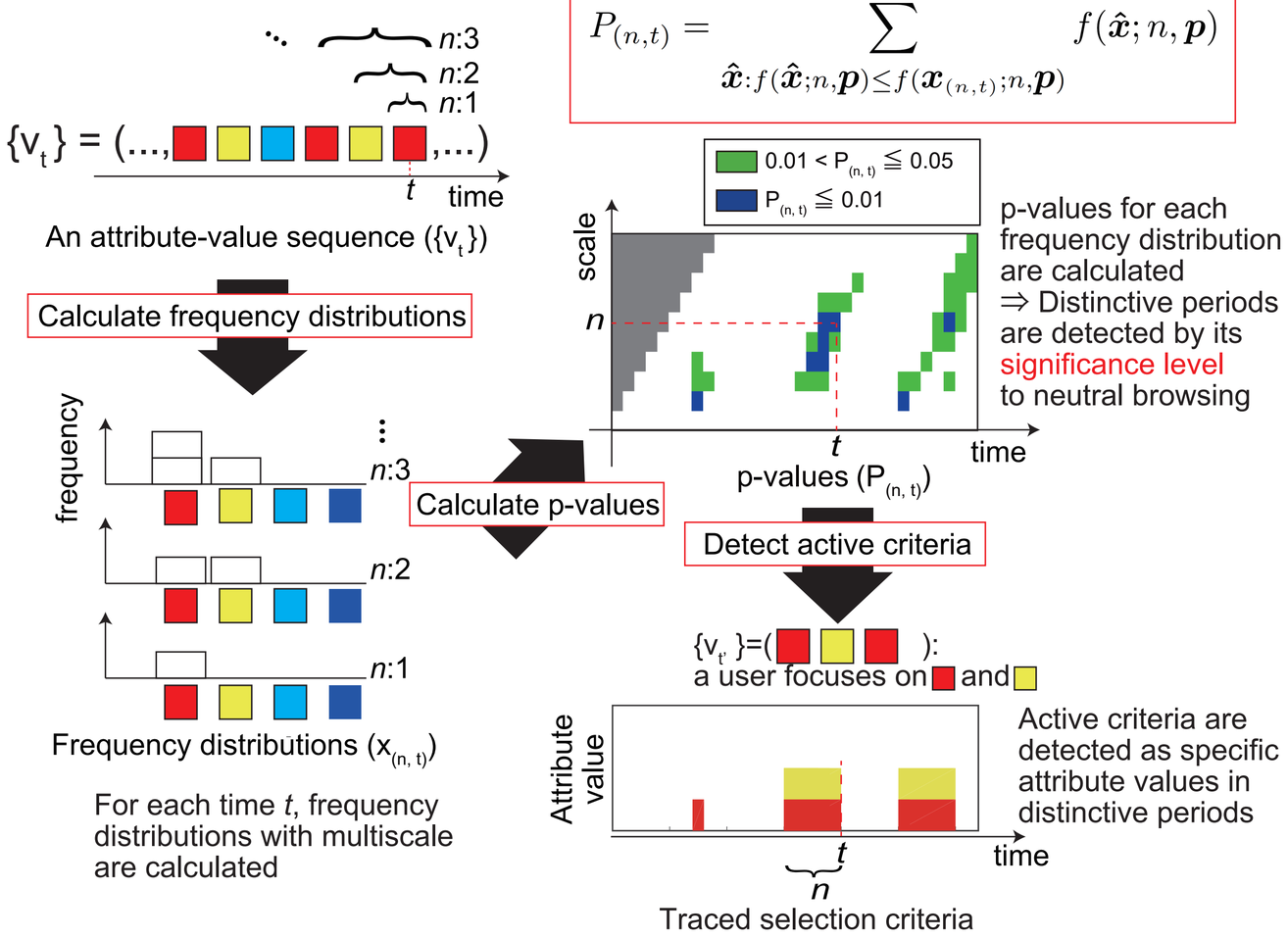
N_k: the number of items that have *k*
N: the number of items on catalog

The frequency distribution *x* in the neural browsing follows multinomial distribution

$$f(\boldsymbol{x}; n, \boldsymbol{p}) = n! \prod_{k=1}^{K} \frac{p_k^{x_k}}{x_k!}$$

x: frequency distribution, sum to *n*
p: multinomial parameter

Multiscale exact test



Preliminary experiments

An example of catalogs

Environment

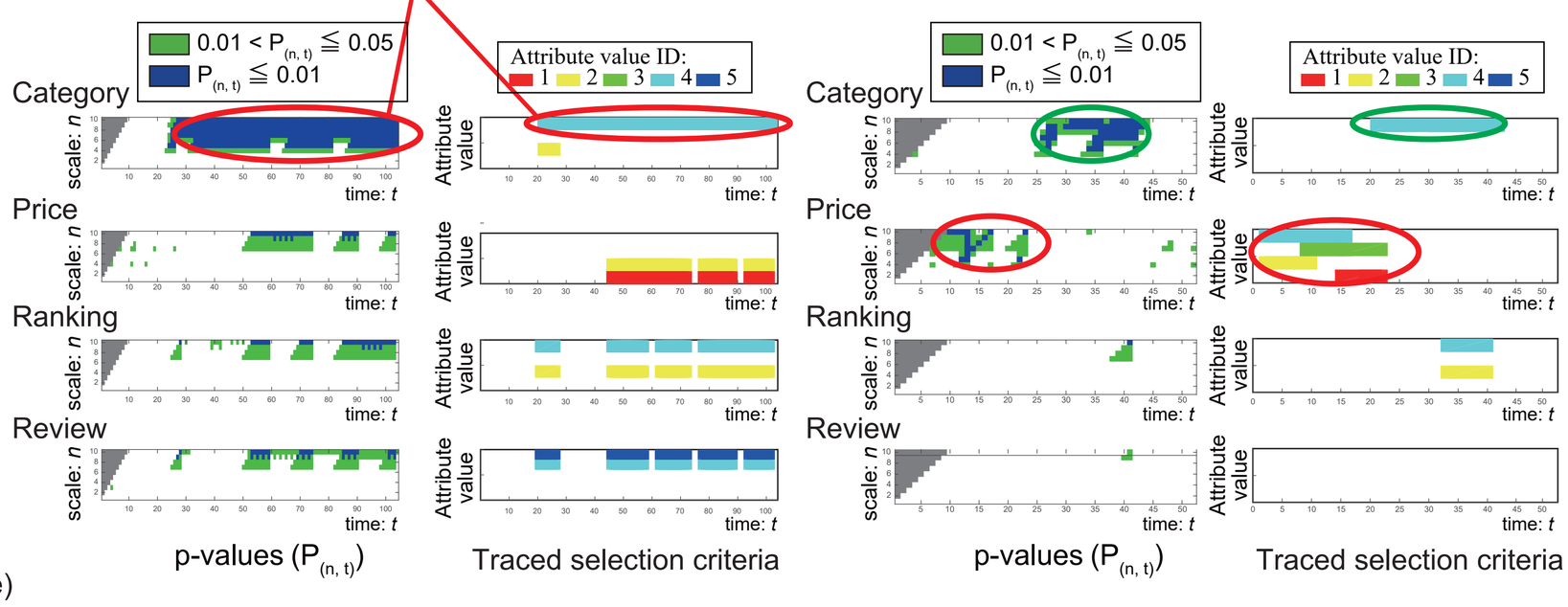
Settings

- 16 items are displayed in each catalog
- Each item has four common attribute types
  -- Category, Price, Ranking, Review
- Participants selected an item based on given task
  -- Task: "Choose an item with the 4th category and more than 4-star review"
  -- Three items were satisfied that specified task
- Items were grouped by their price (see above picture)

Results

The participant first focused on "the 4th category", and compared items.

The participant first compared items in same group (same price).
Then the participant focused on "the 4th category" and compared items.



Conclusion

We propose a method to detect users' distinctive browsing behavior by multiscale exact test so that proposed method can trace temporal changes of selection criteria.

Future work

- Since the proposed method has some limitations because of several assumptions,
  - Each attribute type is categorical
  - Users browse content uniformly

  we will extend proposed model to consider ordinal variables and the effect of layouts.
- Apply the proposed method to interactive system that probes users' decision state by suggesting alternatives based on detected criteria.