

Capturing and Detecting Relevant Mobile Moments

Context Intelligence For Mobile

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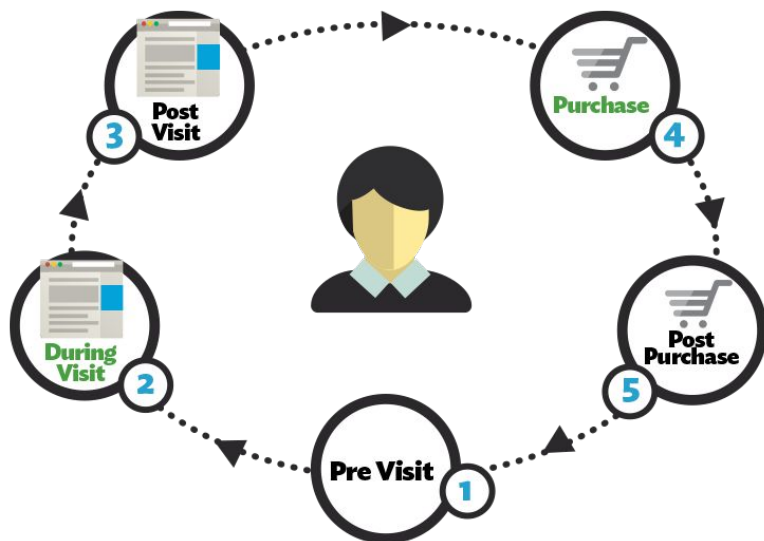
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Keerthana Shanmugam, IIT Madras

Sanket Mehta, Adobe Research Lab

How to model the **real time** behavior of customers in **m-commerce** scenario & what are those **relevant purchase moments(context + intent)** which marketers should focus on?

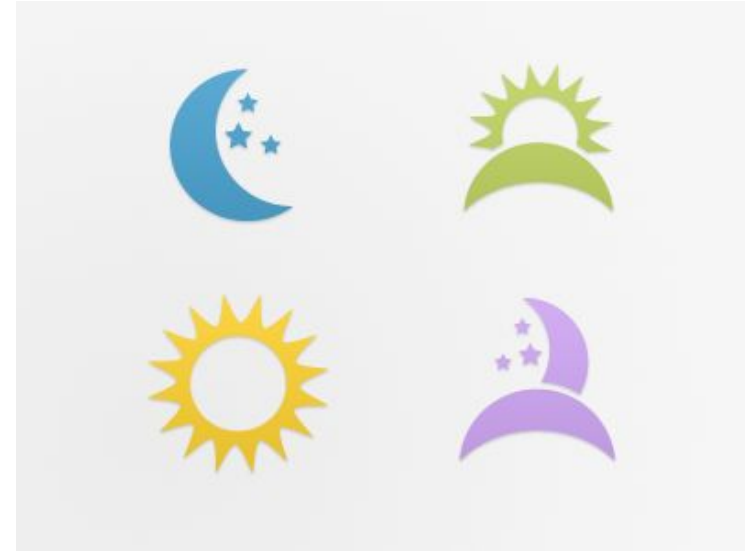
Problem Statement Revisited



Sub Problem 1:

How do we segment the customer-app interaction into sub-sessions for real time modelling?

Problem Statement Revisited



Sub Problem 2:

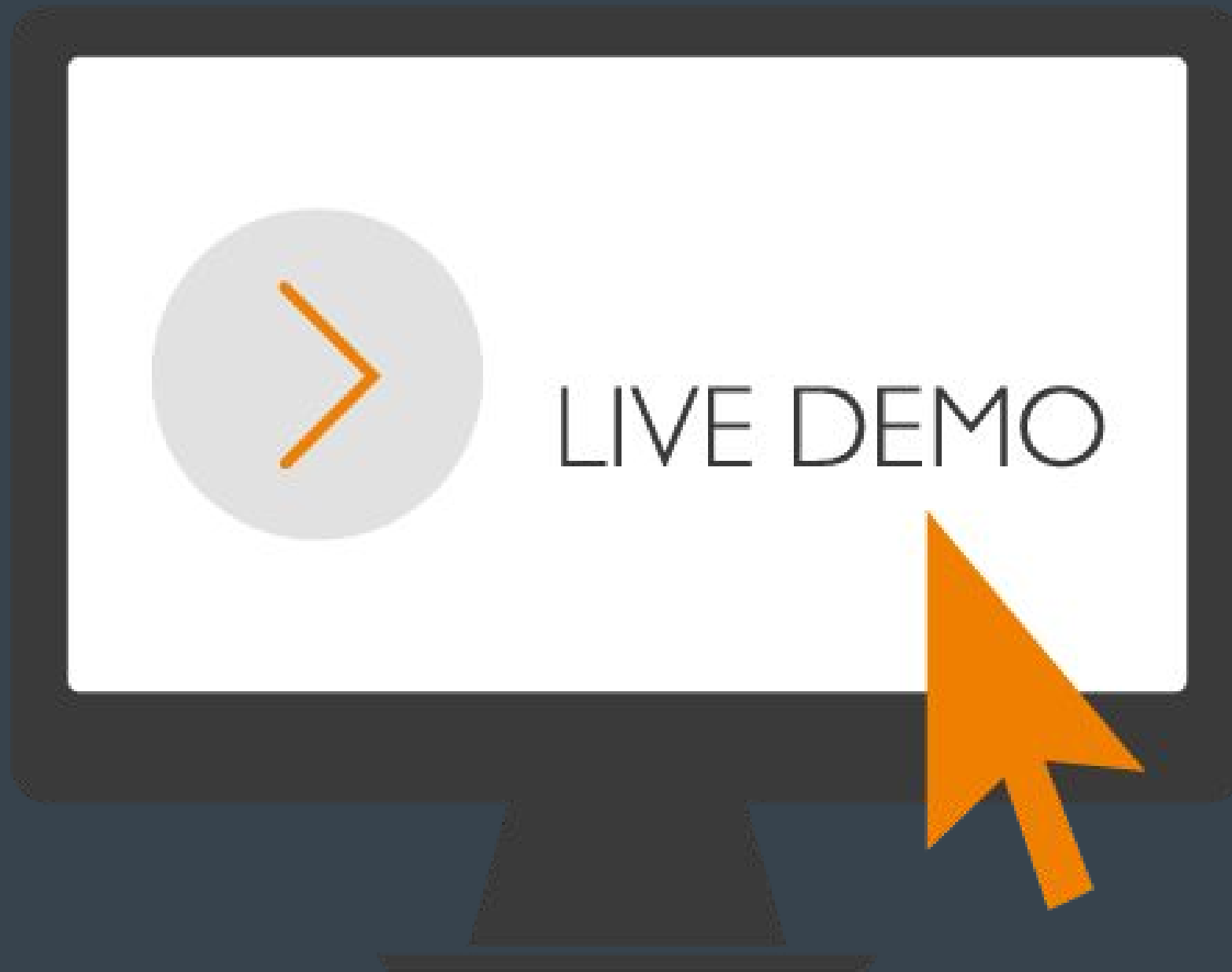
How to acquire and interpret user's context during these app sub-sessions?

Problem Statement Revisited

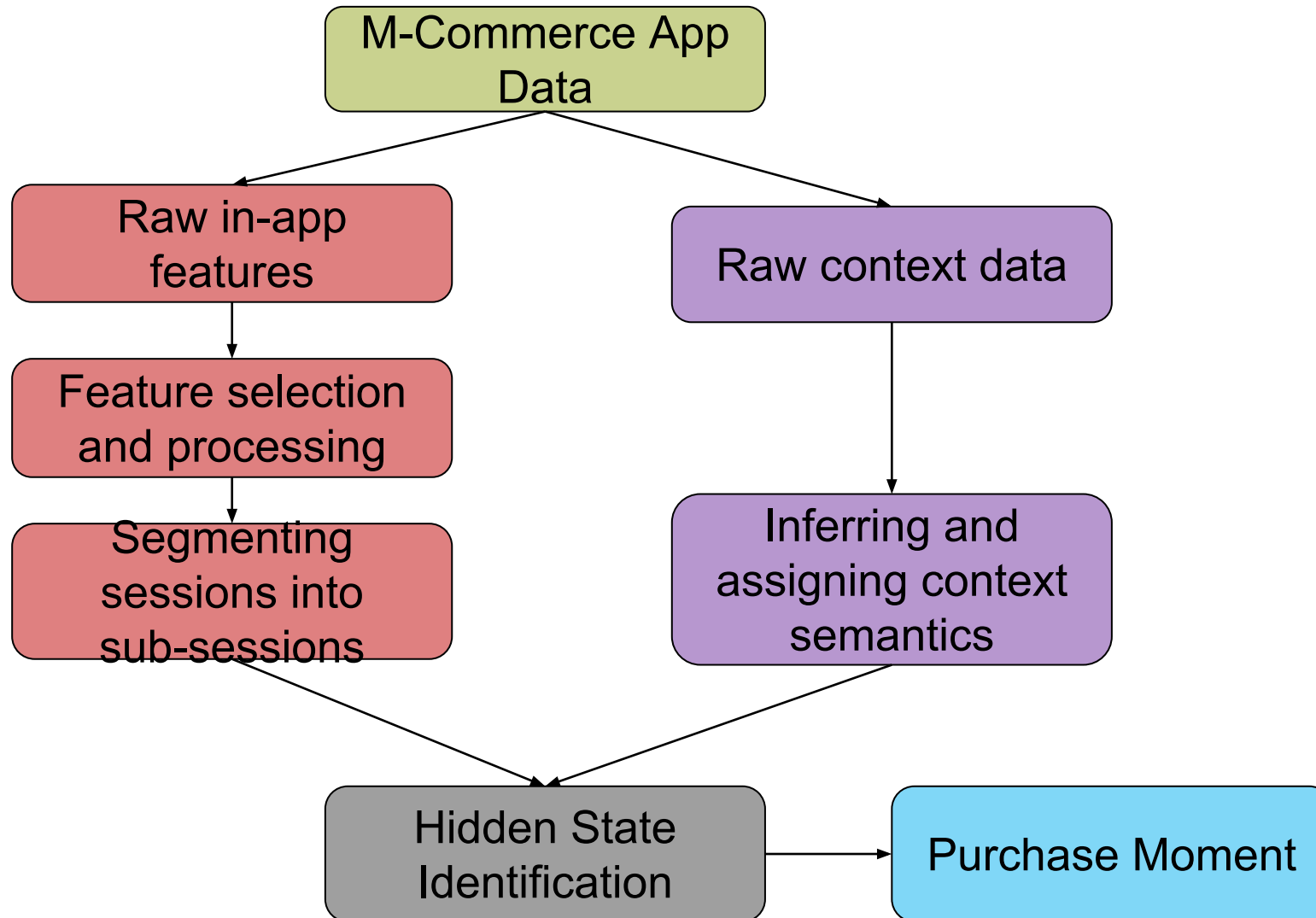


Sub Problem 3:

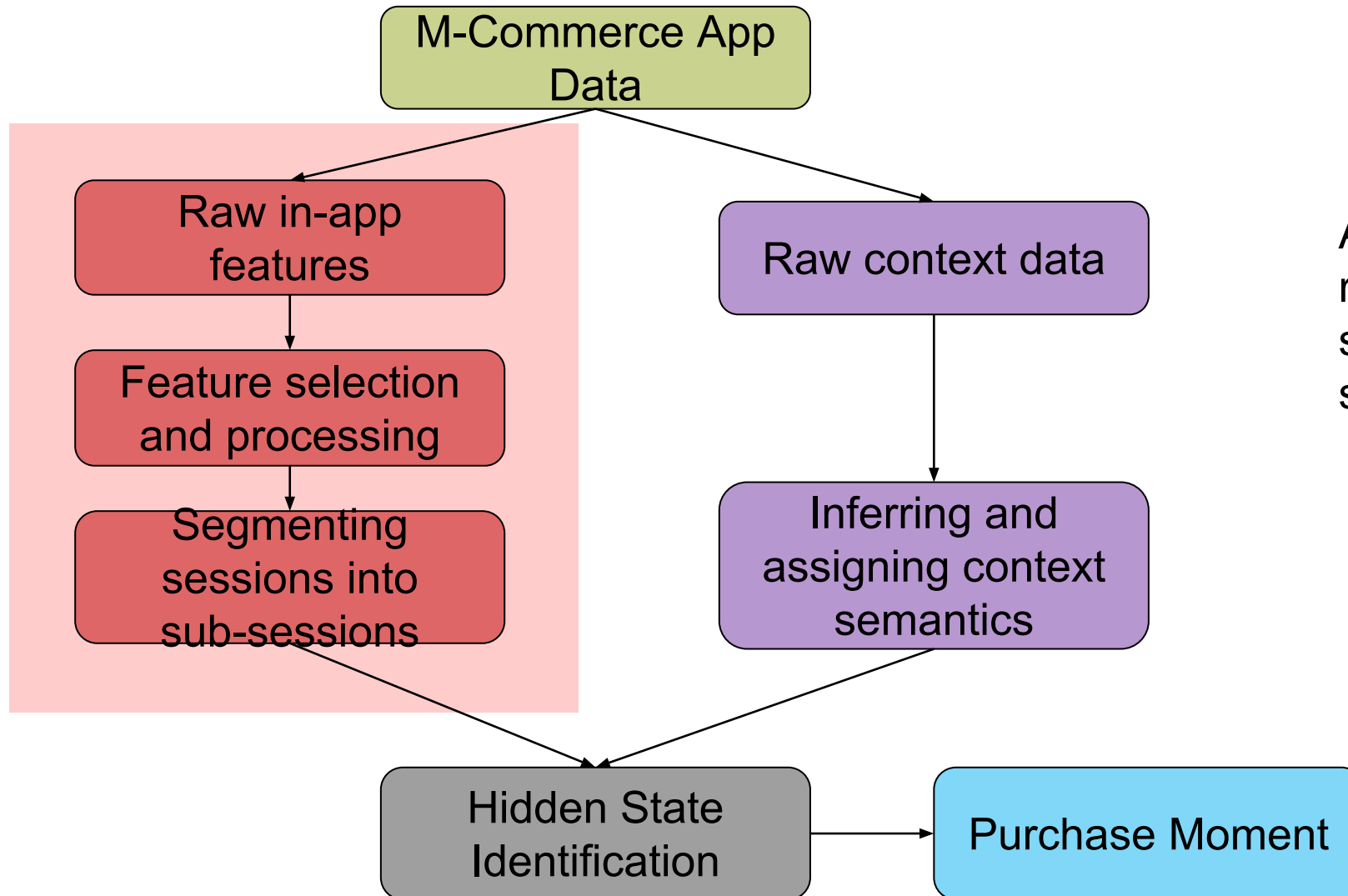
How to detect and quantify relevant purchase moments which the marketer should focus on?



Solution Flow



Sub Problem 1



Analyzing data to extract relevant features and segmenting user sessions into sub-sessions

In App features

- No. of products viewed
- No. of previous purchases
- No. of visits to search page
- No. of juggles between categories

- Time spent on search page
- Time spent on list page
- Time spent on product page
- Time spent on specification page
- Time spent on seller page
- Time spent on review page
- Time spent in image gallery

- Cumulative no. of products viewed
- Cumulative no. of juggles between categories
- Cumulative time spent on search
- Cumulative time spent on product view
- Cumulative time spent on research

In App features

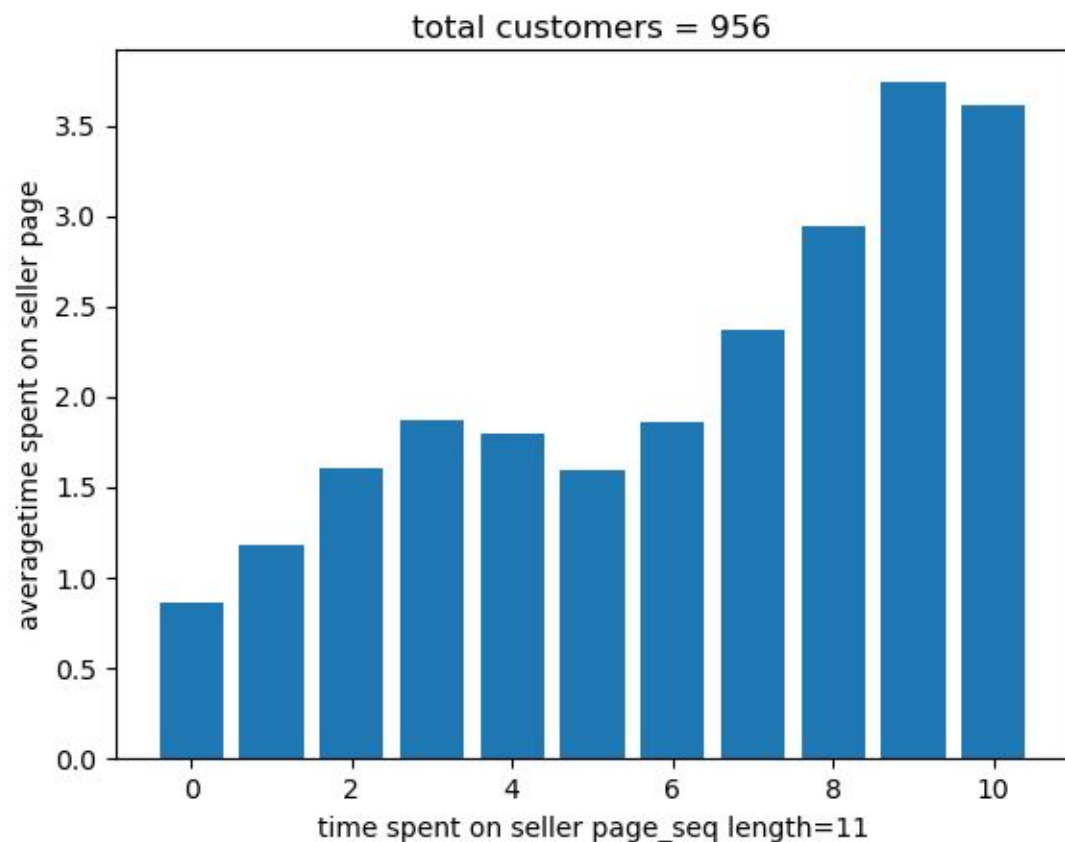
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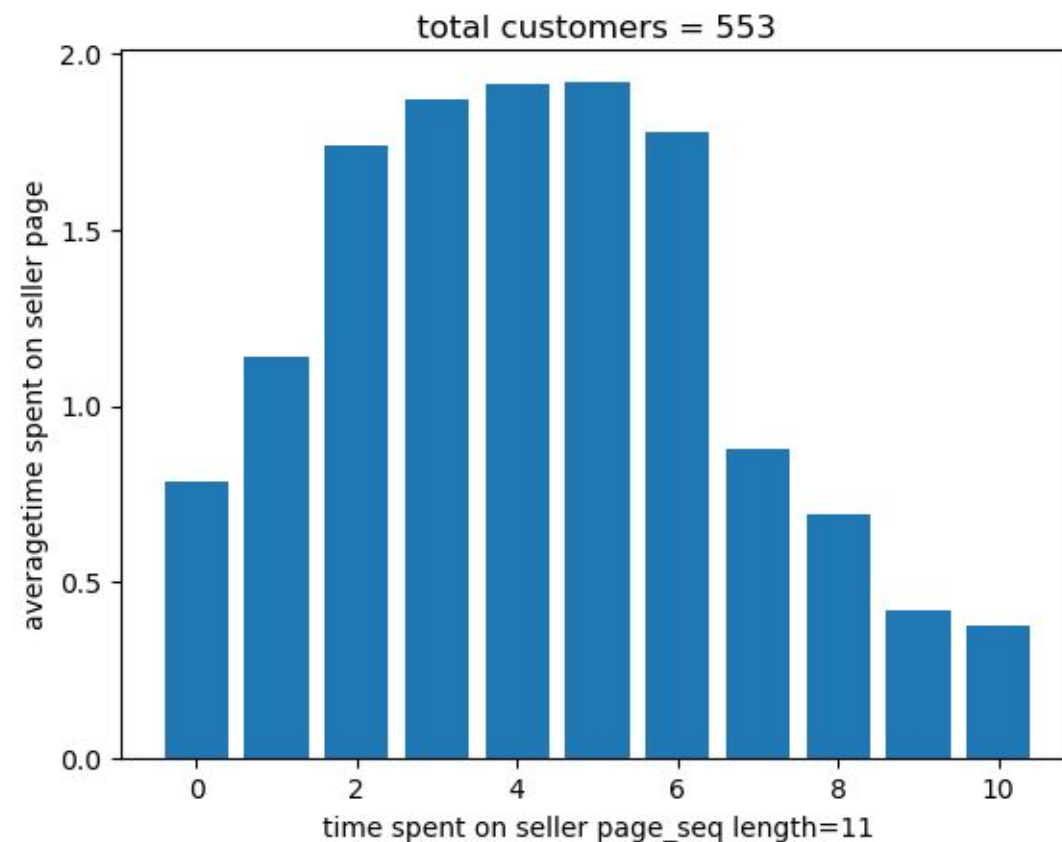
- Time spent on search page
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- Time spent on seller page
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- Time spent in image gallery

Why these features ?

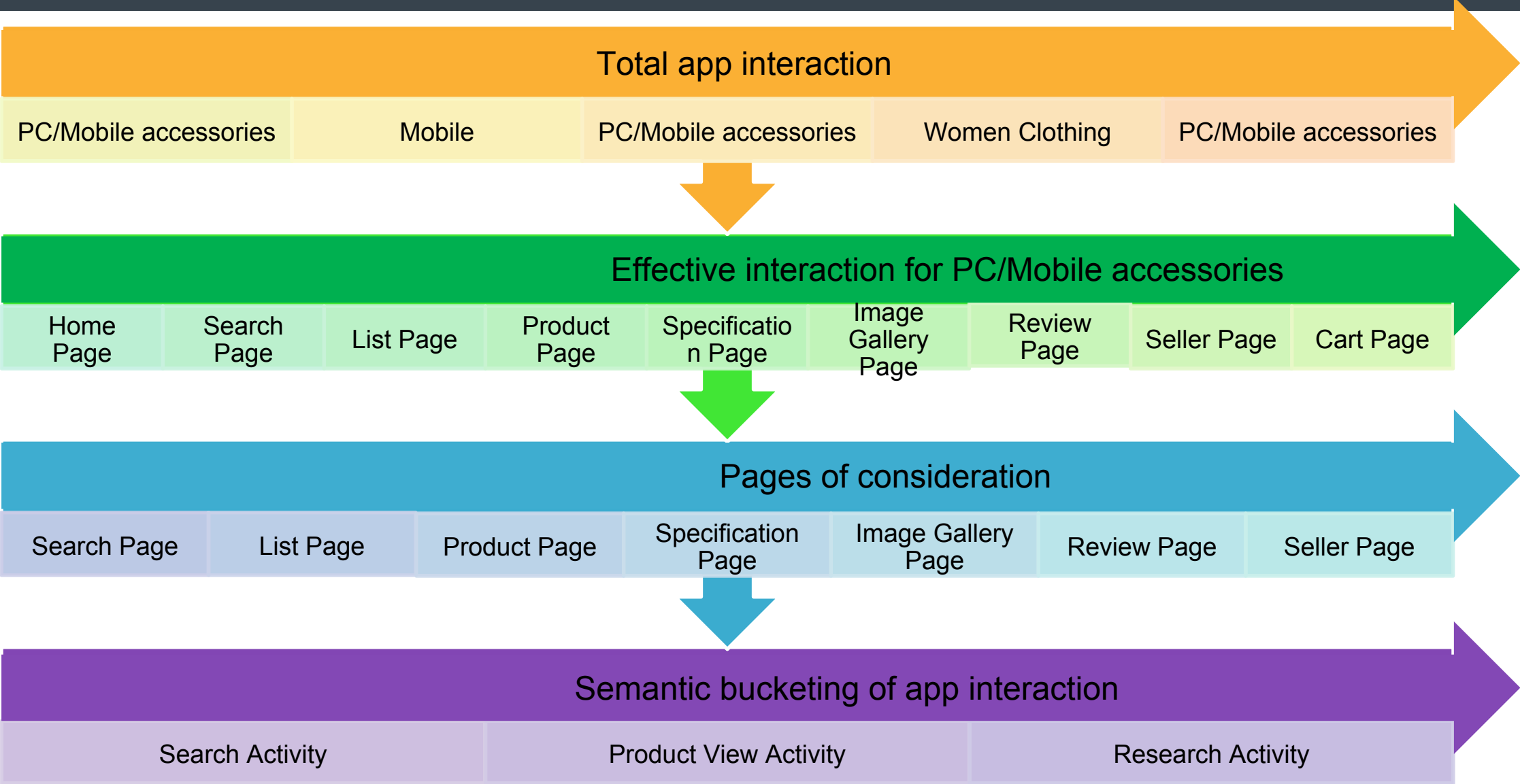
Purchase Customer



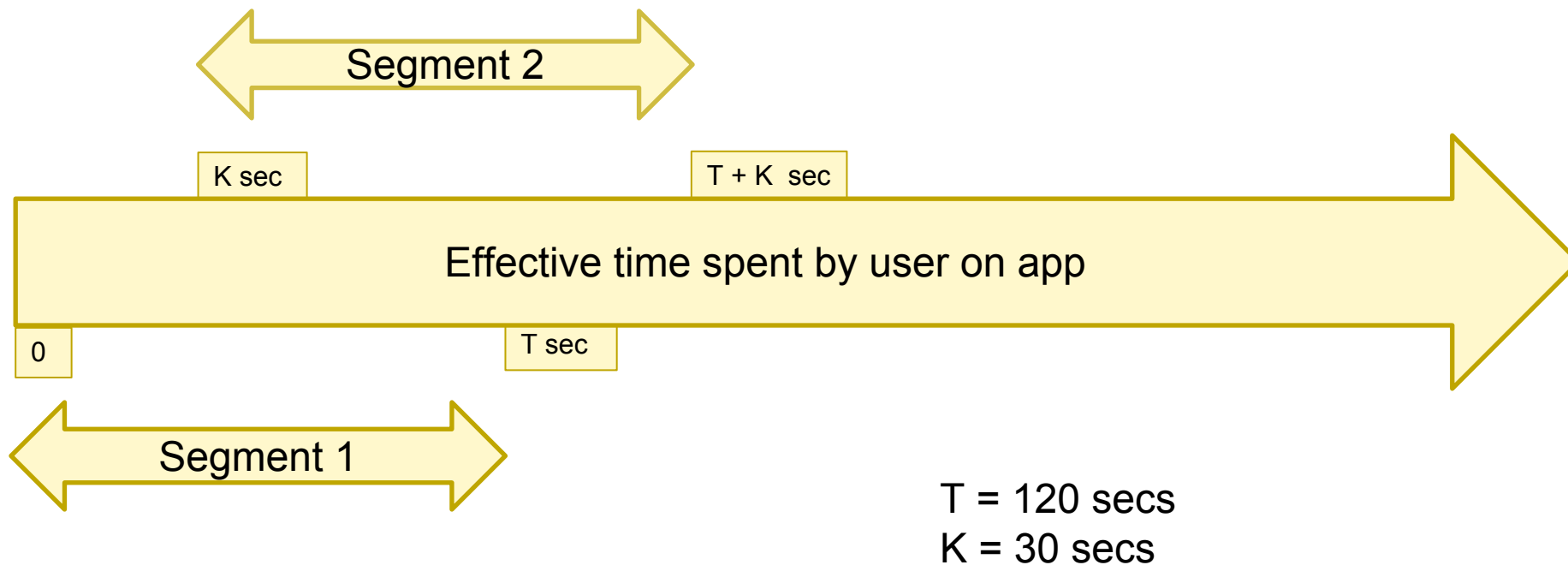
Non Purchase Customer



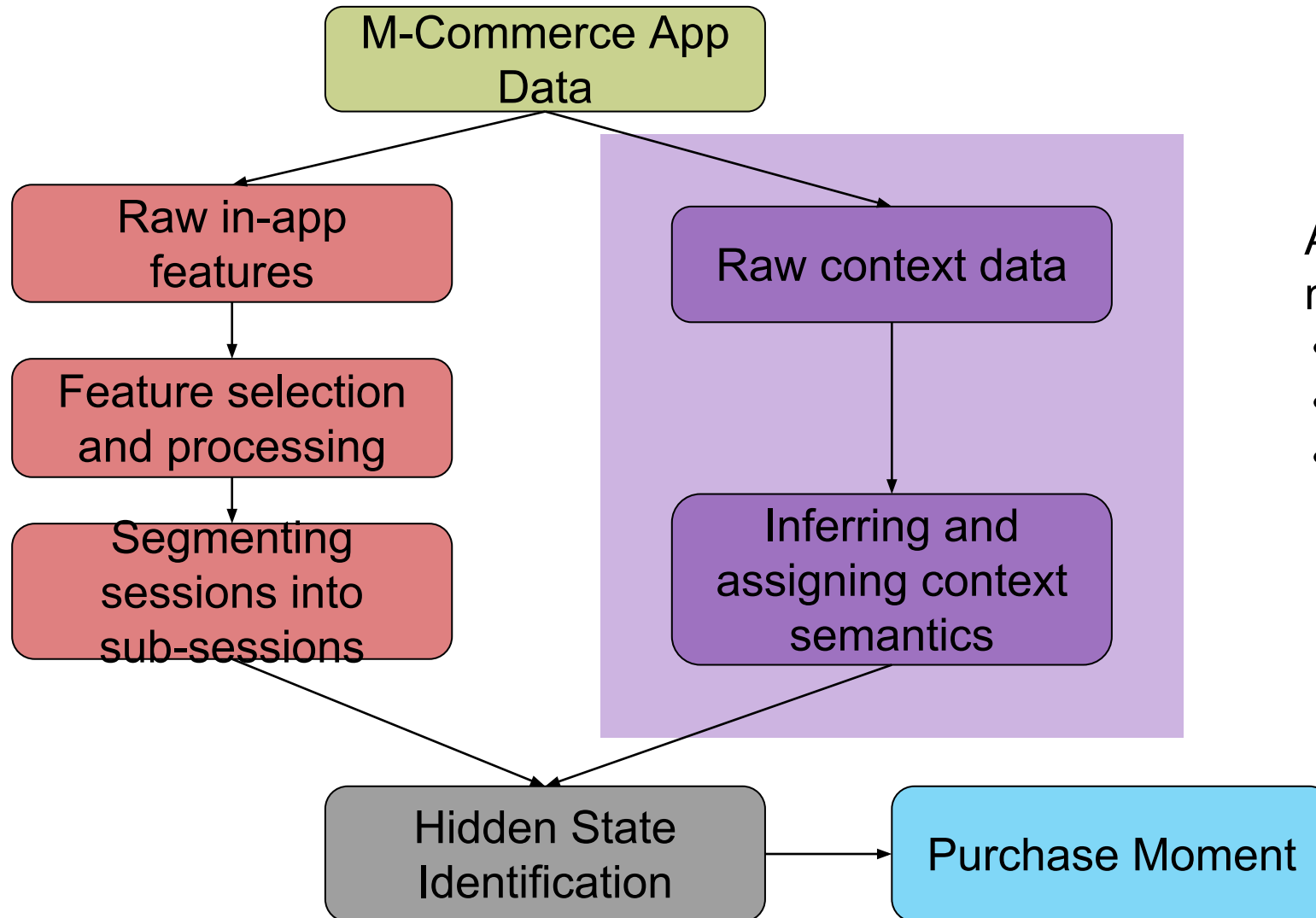
Extracting Relevant Portions of App Interactions



Segmenting Customer Interactions



Sub Problem 2

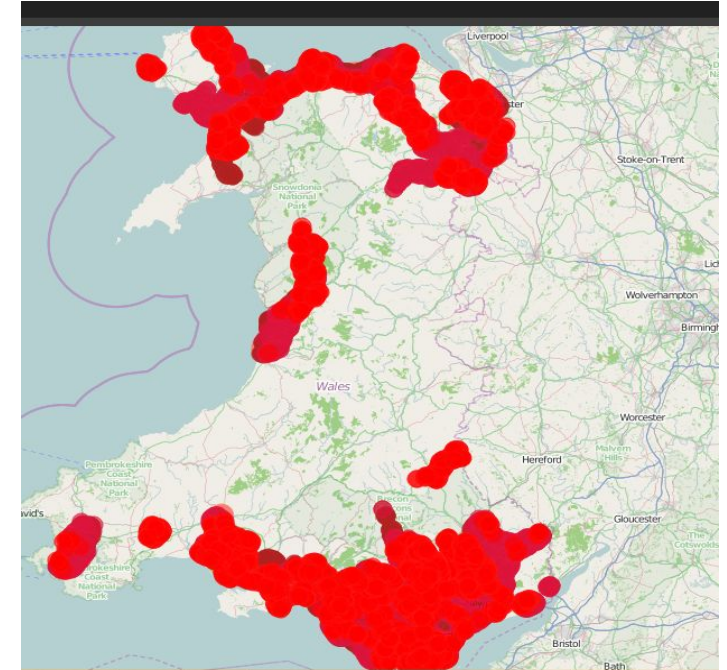


Acquiring context and assigning meaning to context

- Location
- Time of day
- Weekend/ Weekday

Primary Clustering

- DBSCAN (Density Based Spatial Clustering of Applications with Noise)
- Robust to noise
- Arbitrarily shaped clusters

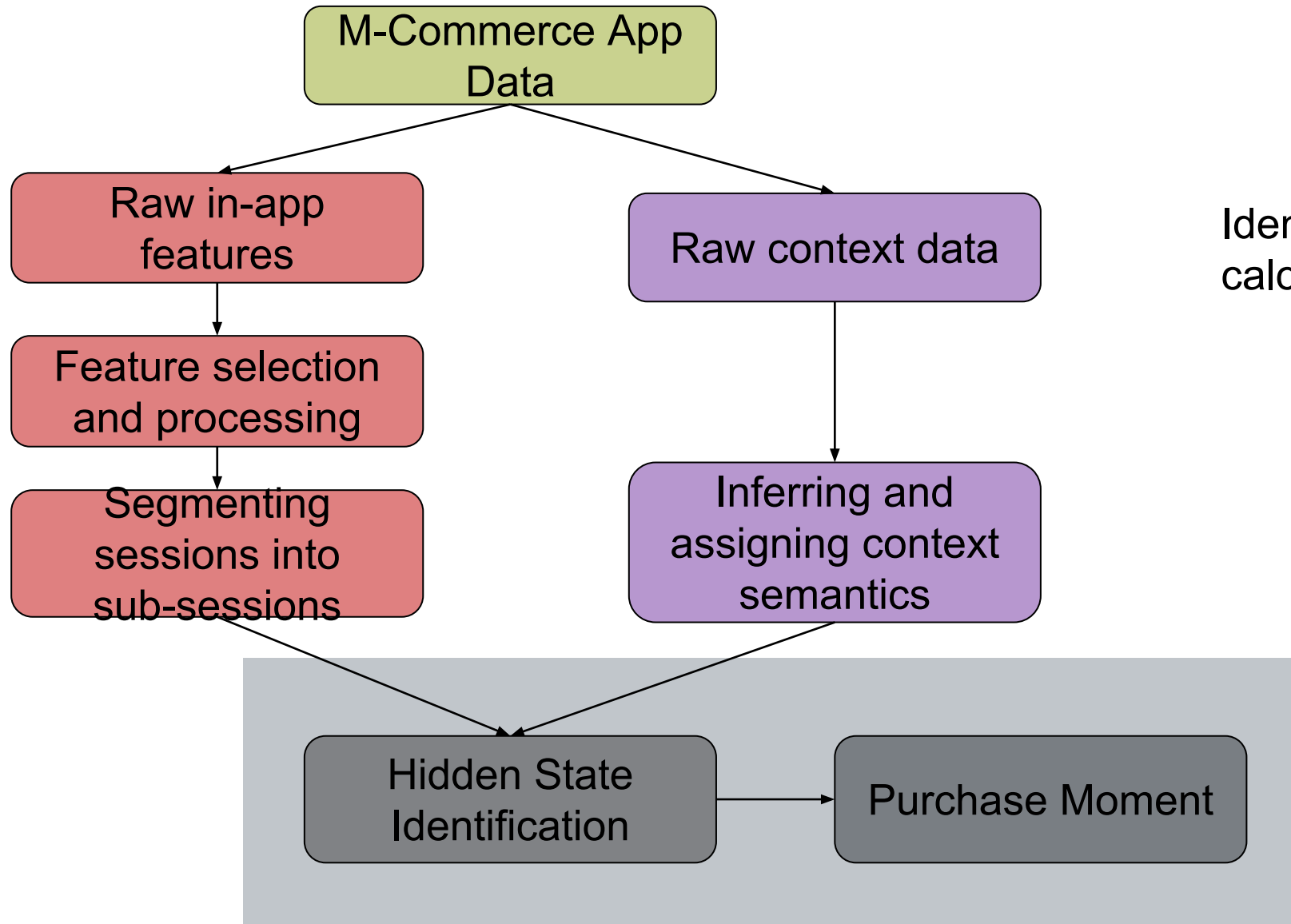


Cluster Labelling

- Home
- Office
- Shopping Malls, Stores, Airports etc.

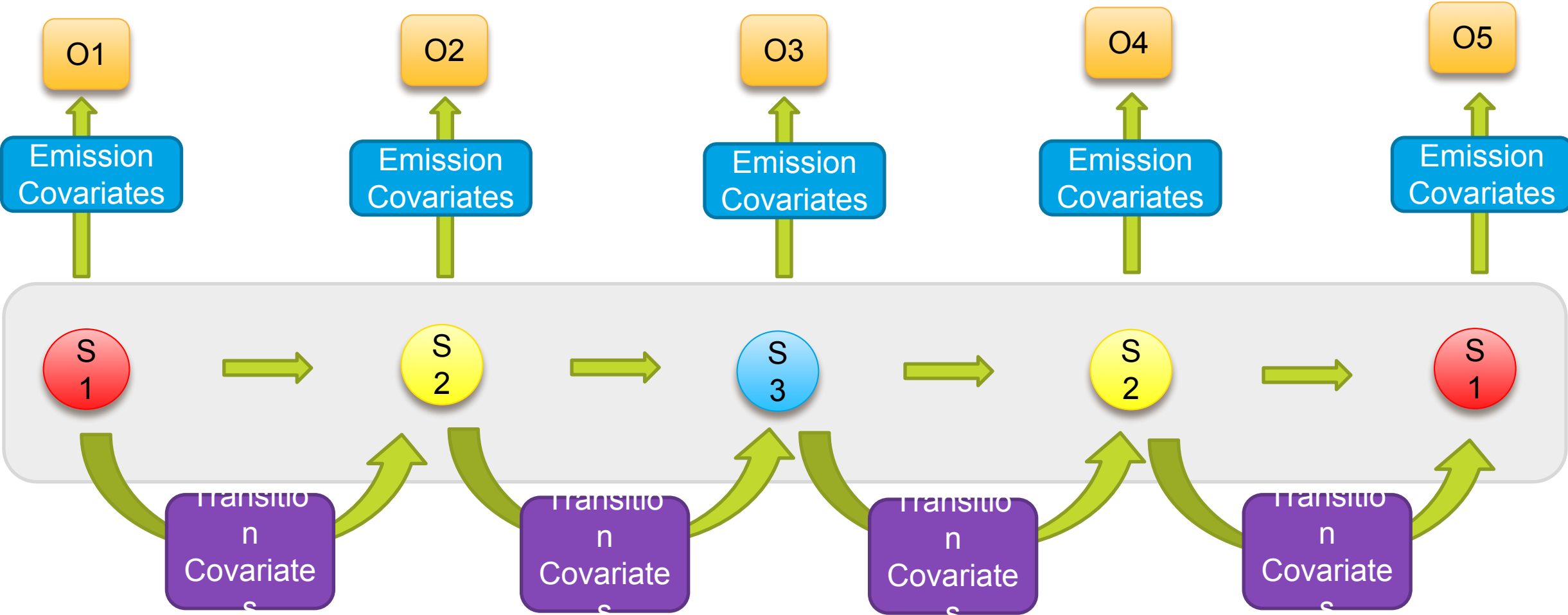


Sub Problem 3



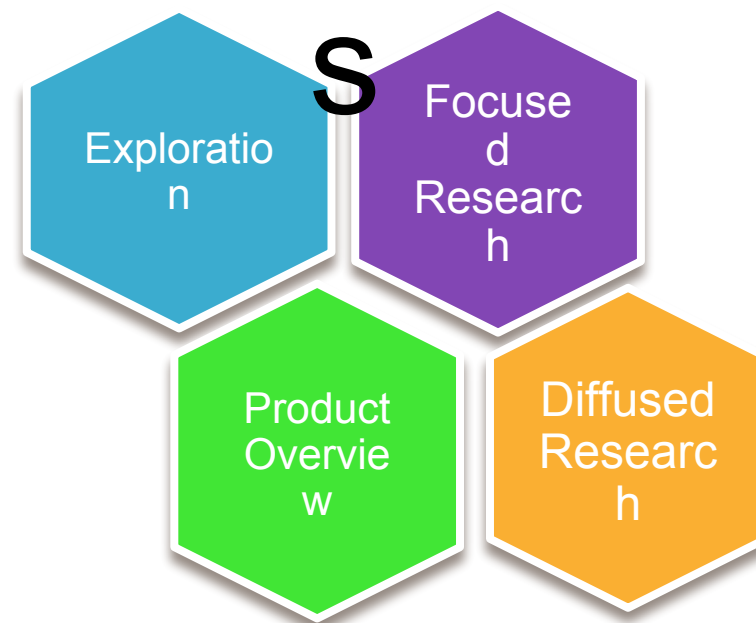
Identifying hidden Intent and calculating purchase probability

Non-homogeneous HMM



| Observables | Emission Covariates for Purchase | Transition Covariates |
|---|--|---|
| <ul style="list-style-type: none">• Search Activity• Research Activity• Product View Activity• Purchase Status | <ul style="list-style-type: none">• Cumulative time on search per segment• Cumulative time on research per segment• Cumulative on product view per segment• Previous purchase history | <ul style="list-style-type: none">• Location Semantics• Time Semantic• Weekend• Mode of entry into app |

State



Mathematical Framework

- Transition Probabilities

$$P(S_{T+1} = s' / S_T = s) = \text{logit}(\beta_{ss'}, x_{iT}, \mu_{ss'})$$

- Current State Purchase Emission Score

$$P(\text{Purchase}_T = 1) = \sum_s P(\text{Purchase}_T / S_T = s) P(S_T = s)$$

$$P(\text{Purchase}_T = 1 / S_T = s) = \text{logit}(\alpha_s, z_{iT}, \tau_s)$$

- Next State Purchase Emission Score

$$P(\text{Purchase}_{T+1} = 1) = \sum_{s'} P(\text{Purchase}_{T+1} = 1 / S_{T+1} = s') \sum_s P(S_{T+1} = s' / S_T = s) P(S_T = s)$$

x_{iT} : Covariates for transition from state s_T to s_{T+1} for segment i

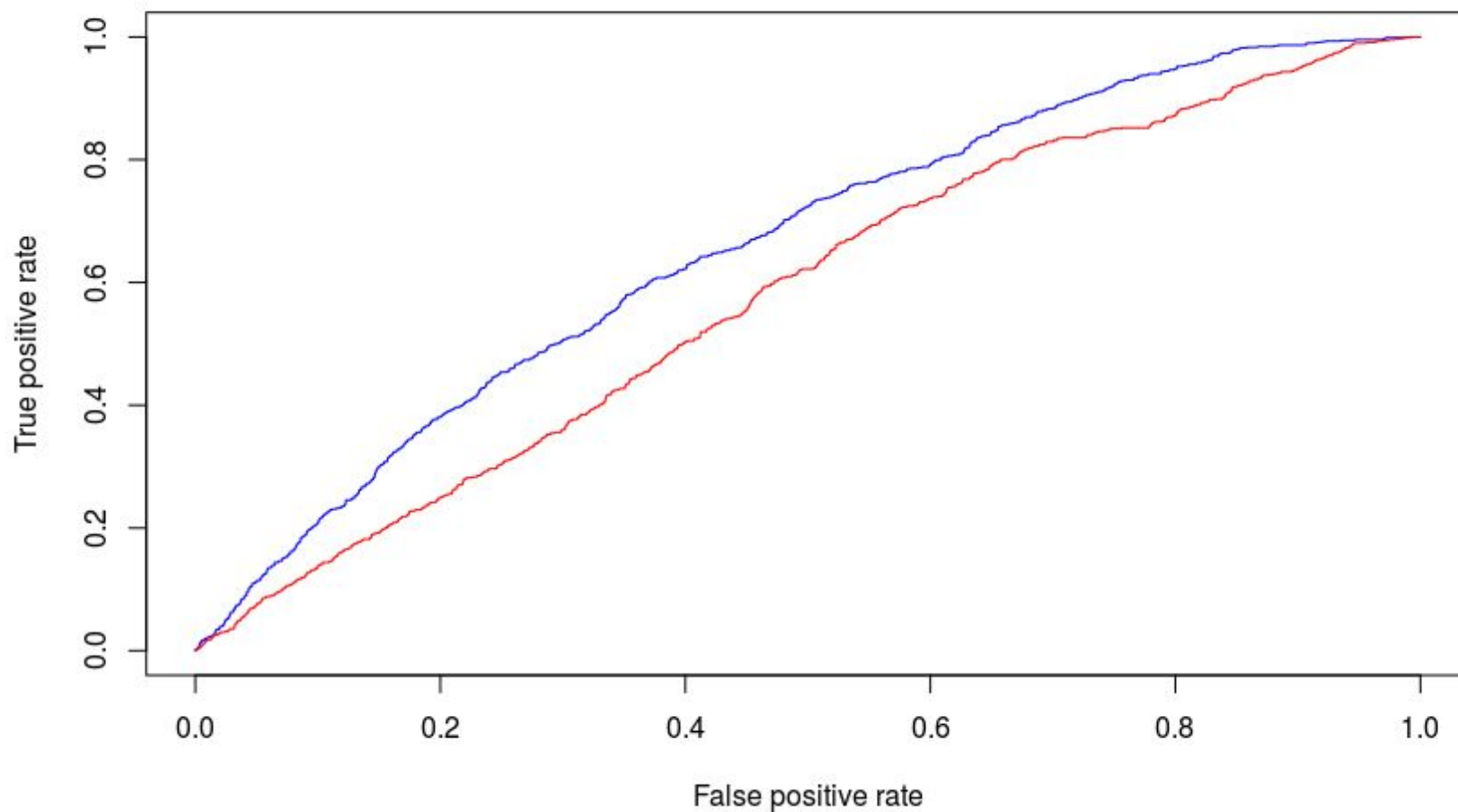
z_{iT} : Covariates for emission for purchase at time t for user i

$\beta_{ss'}, \mu_{ss'}$: Transition parameters

α_s, τ_s : Emission Parameters for purchase

Purchase_T : Purchase in segment T

Results

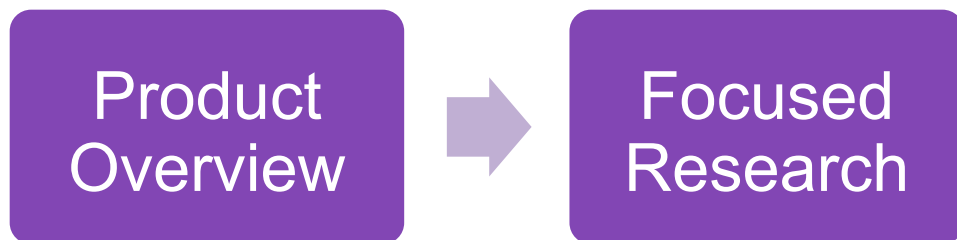


- M-commerce data for 14 days
- 20K customers for training
- 4 sets of 5k customers each for testing

Baseline Model (Logistic Regression)
AUC = 0.578

Proposed Model (NHMM)
AUC = 0.658

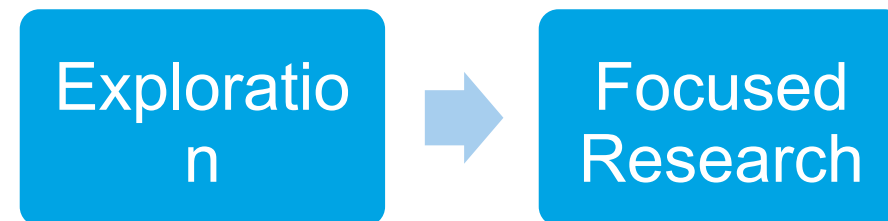
Case 1



- “Weekend + deep-linking” vs “Weekday + notification”
- Probability of transition increased (6.53% vs 5%)

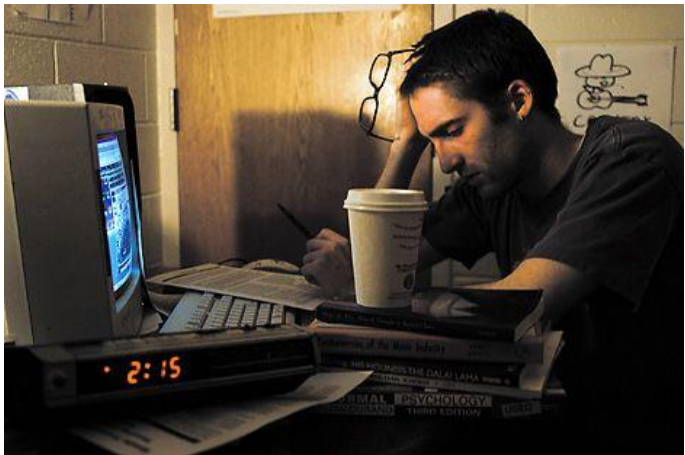
Case 2

- “Home + late night” vs “office + evening”
- More than 3 times increase in probability of transition (0.7% vs 0.22%)





Bragging



Patent

Context driven real time behavior of customers in m-commerce scenario to predict purchase score

Paper

Modelling context driven user behavior in m-commerce using nonhomogeneous hidden markov model to determine relevant purchase moments

Acknowledgements



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Ganguly

Questions?



Adobe