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## Conference Poster

**Author(s):**

Ordóñez Medina, Sergio A.

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# Inferring weekly primary activity patterns using public transport smart card data and a household travel survey

Sergio Arturo Ordóñez Medina  
Singapore ETH Centre

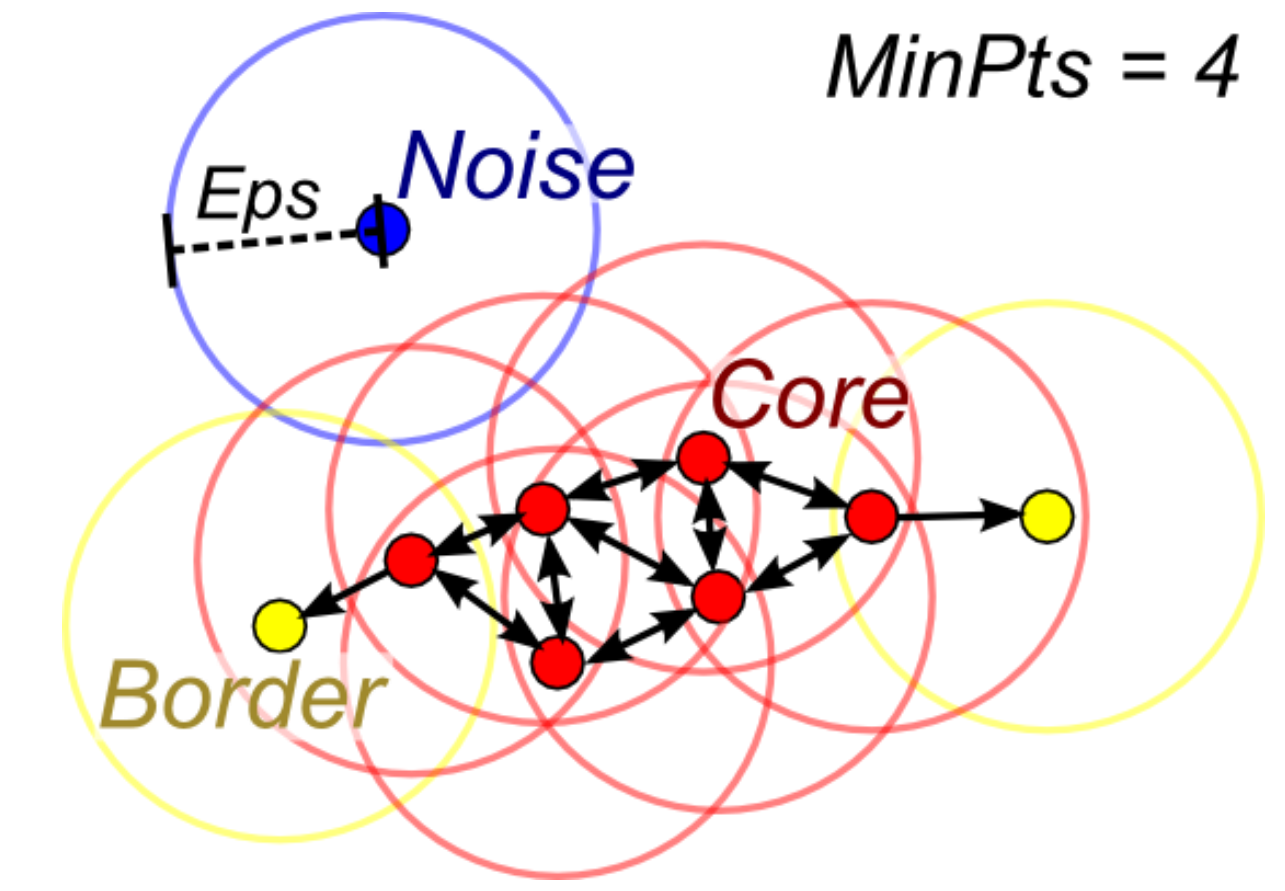
- With public transport **smart cards**, massive spatio-temporal data have been recorded in many cities.
- This work presents a method to identify temporal **weekly patterns** of primary activities performed by public transport users in **Singapore**.
- According to the start time and duration of an activity, activities are classified in **HOME**, **WORK/STUDY** or **OTHER**.
- **DBSCAN** clustering algorithm was applied to recognize the most common primary activity patterns of

## Weekly pattern recognition

- **DBSCAN** clustering:

14-dimension vectors

Weekly pattern:	St. time	Duration
Mo	D1	D8
Tu	D2	D9
We	D3	D10
Th	D4	D11
Fr	D5	D12
Sa	D6	D13
Su	D7	D14



MinPts = 4

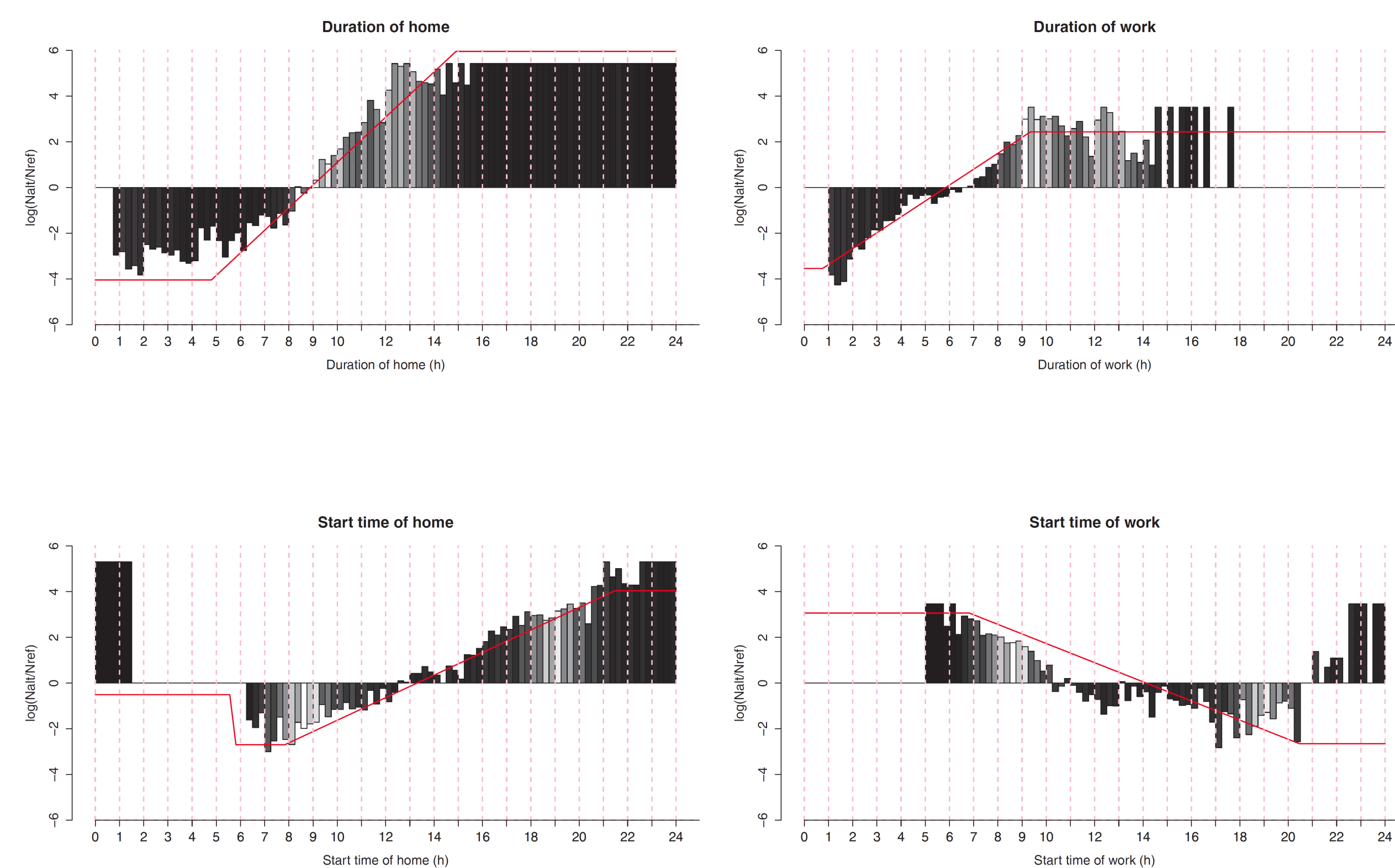
DBSCAN distance function

$$D(\mathbf{u}, \mathbf{v}) = p(\mathbf{u}, \mathbf{v}) + \sum_{w \in W} abs(\mathbf{u}_{w,du} - \mathbf{v}_{w,du}) + abs(\mathbf{u}_{w,st} - \mathbf{v}_{w,st})$$

$$p(\mathbf{u}, \mathbf{v}) = \begin{cases} 12h & \text{if } \mathbf{u} \text{ and } \mathbf{v} \text{ are intuitively different} \\ 0 & \text{if } \mathbf{u} \text{ and } \mathbf{v} \text{ are not intuitively different} \end{cases}$$

## Activity type detection

### Work



$$V_{aHome} = K_{home} + \beta_{homeD}d_{5-15} + \beta_{homeS}s_{18-21}$$

$$V_{aWork} = K_{work} + \beta_{workD}d_{1-9} + \beta_{workS}s_{7-20}$$

$$d_{x-y} = \begin{cases} 0 & d_a < x \\ d_a - x & x < d_a < y \\ y & d_a > y \end{cases}$$

$$s_{x-y} = \begin{cases} 0 & s_a < x \\ s_a - x & x < s_a < y \\ y & s_a > y \end{cases}$$

Parameter	Value	t-test
$K_{home}$	-6.41	-43.50
$\beta_{homeD}$	0.884	46.92
$\beta_{homeS}$	0.494	36.60
$K_{work}$	-2.79	-24.58
$\beta_{workD}$	0.685	46.16
$\beta_{workS}$	-0.143	-12.03

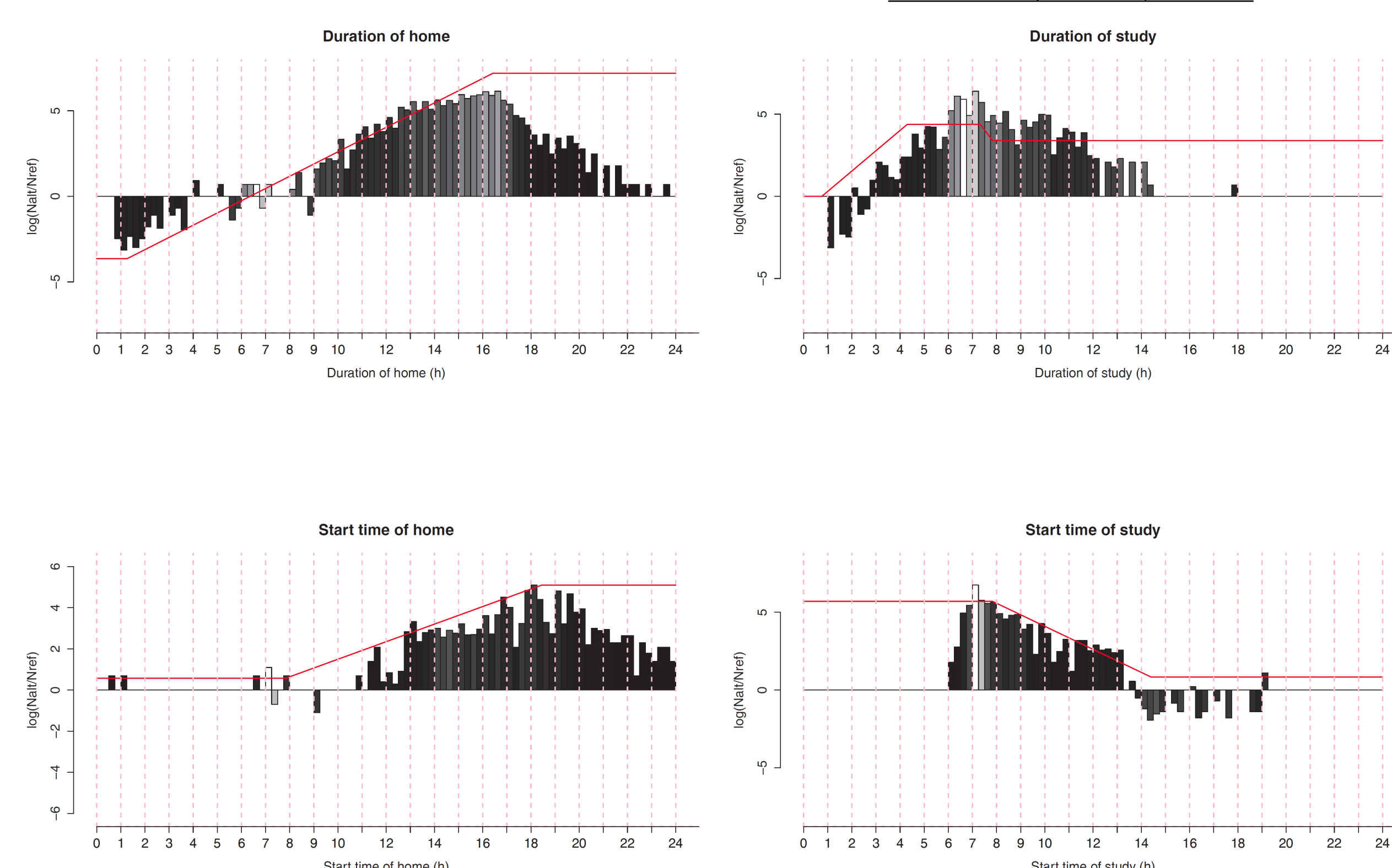
$$V_{aHome} = K_{home} + \beta_{homeD}d_{1-16} + \beta_{homeS}s_{8-18}$$

$$V_{aStudy} = K_{study} + \beta_{studyD1}d_{1-4} + \beta_{studyD2}d_{7-8} + \beta_{studyS}s_{8-14}$$

$$d_{x-y} = \begin{cases} 0 & d_a < x \\ d_a - x & x < d_a < y \\ y & d_a > y \end{cases}$$

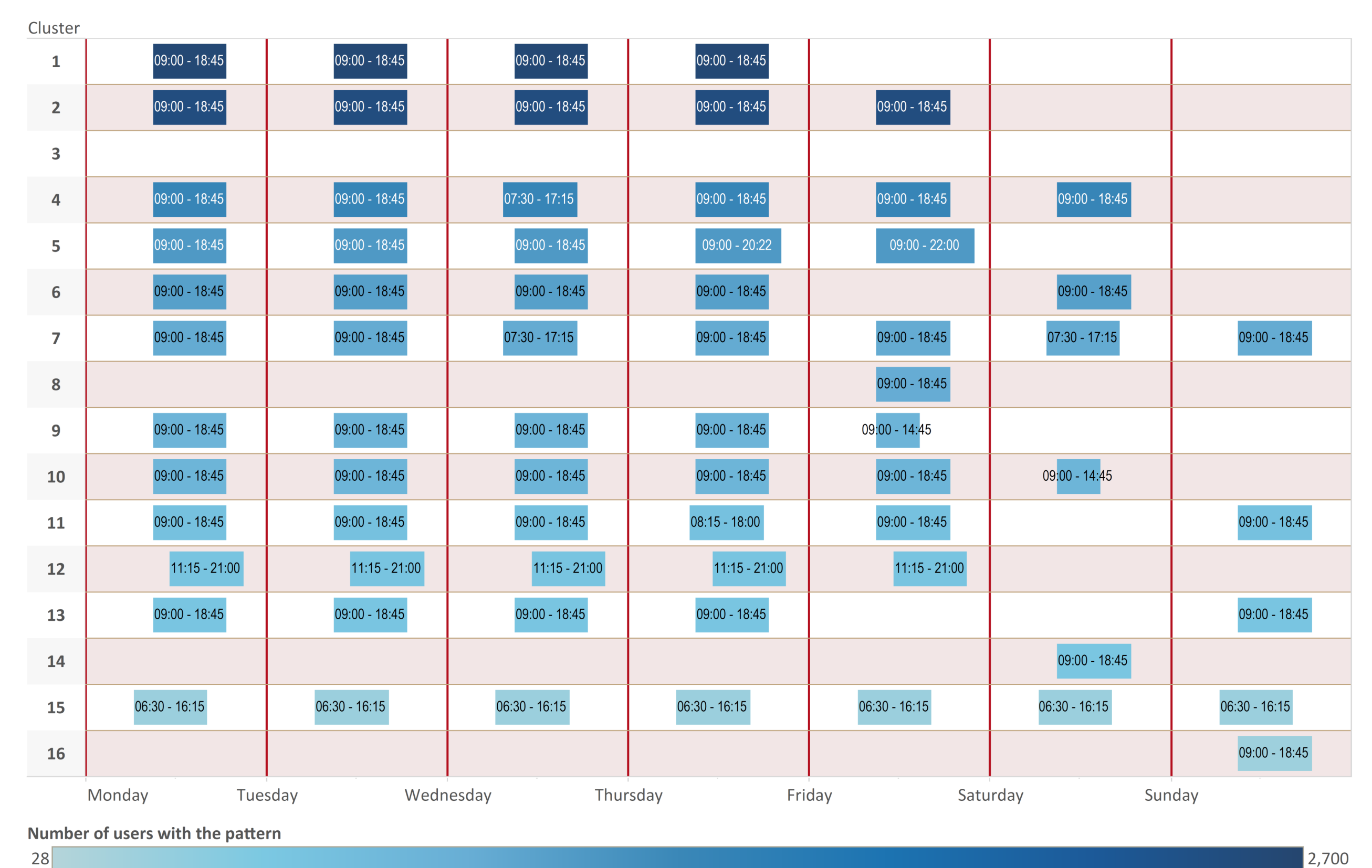
$$s_{x-y} = \begin{cases} 0 & s_a < x \\ s_a - x & x < s_a < y \\ y & s_a > y \end{cases}$$

Parameter	Value	t-test
$K_{home}$	-6.07	-12.94
$\beta_{homeD}$	0.722	17.90
$\beta_{homeS}$	0.431	8.67
$K_{study}$	1.7	3.14
$\beta_{studyD1}$	1.25	9.16
$\beta_{studyD2}$	-1.97	-2.71
$\beta_{studyS}$	-0.748	-11.53

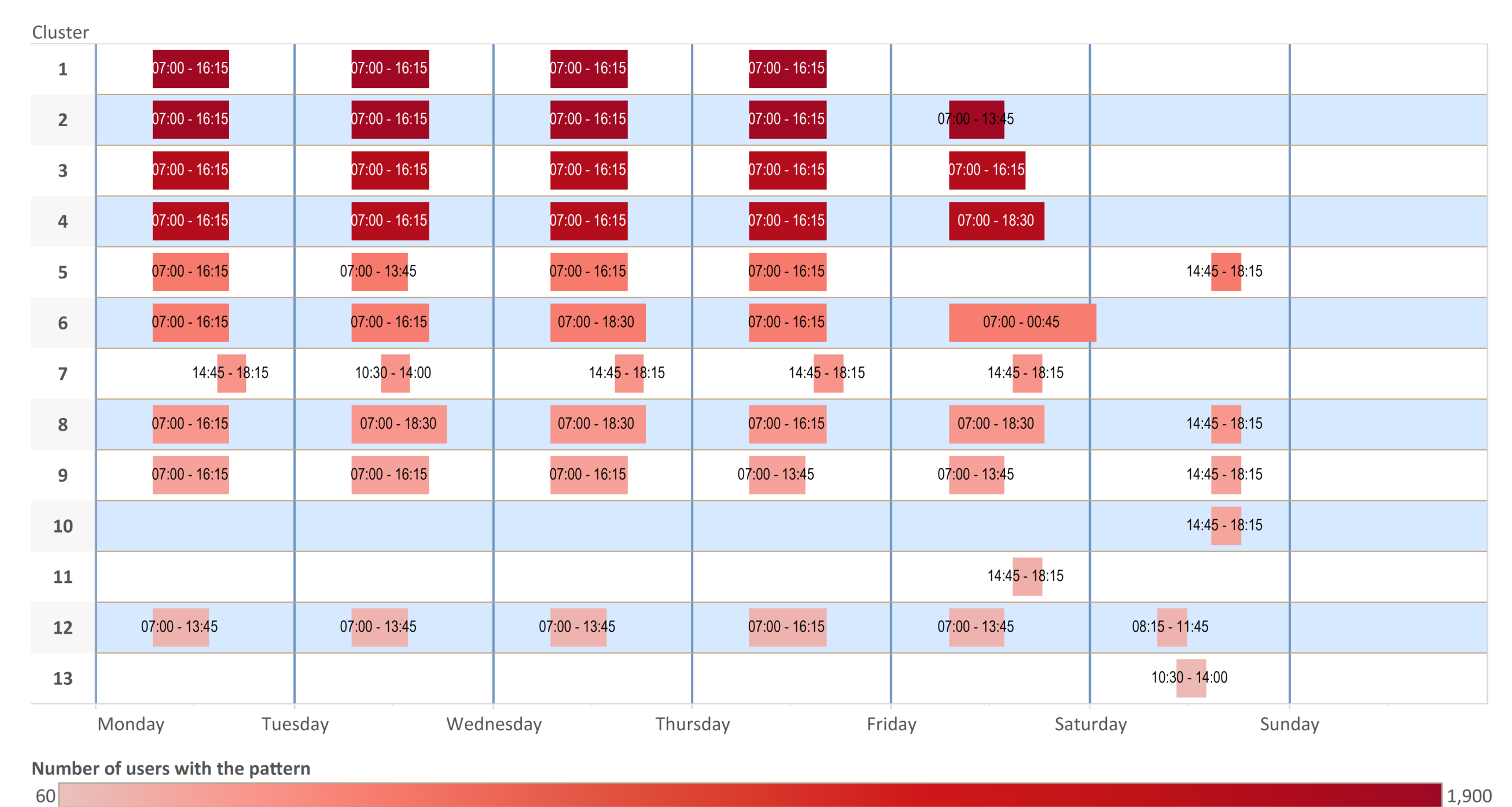


### Study

- **Workers' clusters:**



- **Students' clusters:**



- Temporal weekly patterns of primary activities performed by frequent public transport users in **Singapore** were recognized using Smart Card Data from public transport transactions.
- **DBSCAN** was successfully employed to recognize weekly patterns of workers and students.
- Results show that **5-weekday workers** are the most representative group.
- The largest individual cluster represents frequent PT users **working** every weekday **except Friday**.
- Largest **student** clusters represent studying more than **8 hours** during the 5 weekdays.