How Routine Learners can Support Family Coordination

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Overview

- How Routine Learners can Support Family Coordination
- Learning Patterns of Pick-ups and Drop-offs to Support Busy Family Coordination
- Unremarkable Computing

How Routine Learners can Support Family Coordination

Intention

- Discussion of conceptual feasibility

- Roadmap

- 1. Analyze what families would find valuable
  2. Come up with a solution

Data Collection (1)

- 6 dual-income families
- 6 months

Data Collection (2)

- Quantitative
    - Six month of field observation
        - Four families completed
        - 528 unique interview sessions
        - 2112 person days

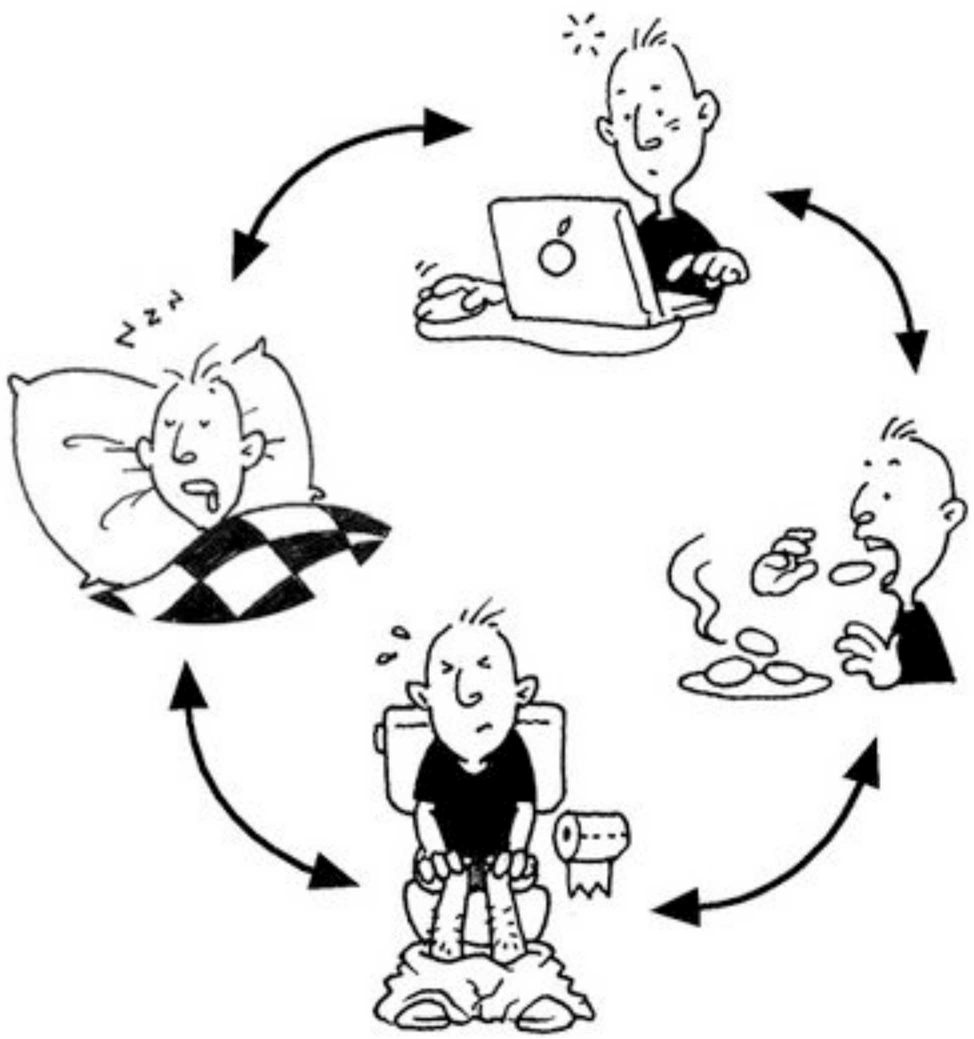
Data Collection (3)

- Qualitative
  - Evaluation of knowledge of others routines (Activity interviews)
  - Identification of routine or non-routine

Contributions (1)

Routines and family life

40 %



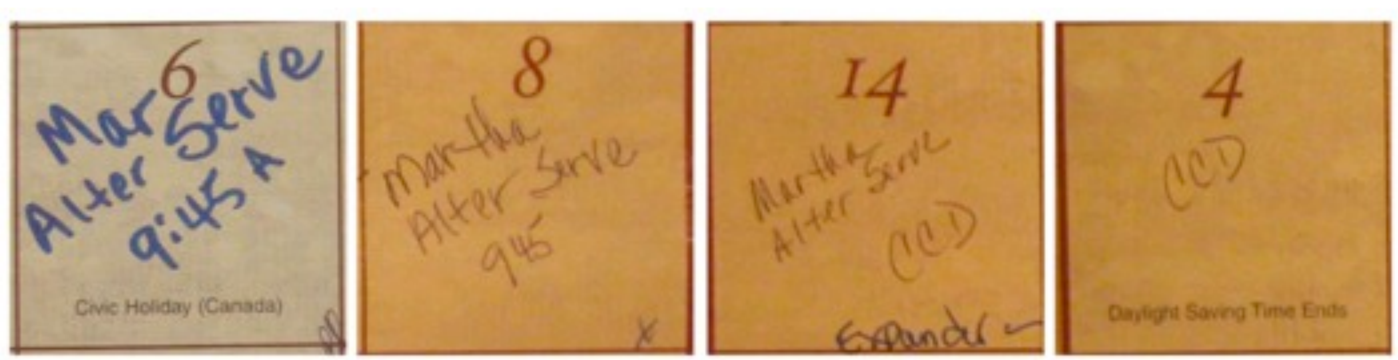
Contributions (2)

Routine knowledge of others is incomplete or inaccurate

Contributions (3)

Calendars hold deviations not routine

90 %



Contributions (4)

Small information gaps lead to stressful situations

Future Potential

- Access to routine
- Augmented calendars
- Augmented reminders
- Use of more sensors
- Better routine detection algorithms

Reviews (1)

- Rating: 2 (accept)
- Positive
  - Extensive data collection
  - Base for applications supporting family coordination
  - Interesting to read with many examples

Reviews (2)

- Negative
  - No technical aspects
  - Only GPS location
  - Children and mobile phones

Learning Patterns of Pick-ups and Drop-offs to Support Busy Family Coordination

Setup

- Dual-income families
- GPS location data (once per minute)
- Data from first paper

Intention

- Pick-ups and drop-offs
  - Detect pick-ups and drop-offs
  - Predict driver
  - Infer if child will be forgotten

Recognizing Rides (1)

- States

$$States = \{L_n, T \mid CoT, else\}$$

- People

$$People = \{P, C\}$$

Recognizing Rides (2)

- Pick-up

$$(t_1,P,\neg CoT) \wedge (t_1,C,L_n) \wedge$$
$$(t_2,P,L_n) \wedge (t_2,C,L_n) \wedge$$
$$(t_3,P,CoT) \wedge (t_3,C,CoT)$$

- Drop-off

$$(t_1,P,CoT) \wedge (t_1,C,CoT) \wedge$$
$$(t_2,P,L_n) \wedge (t_2,C,L_n) \wedge$$
$$(t_3,P,\neg CoT) \wedge (t_3,C,L_n)$$

Recognizing Rides (3)

- Precision 90.1 %
- Recall 95.5 %

Predicting Drivers (1)

- Feature Vector

Name	*Meaning*	*Values*
L_n	Location of pick-up or drop-off	Place ID
RType	Ride type	Pick-up, Drop-off
DoW	Day of week	0,1,2,3,4,5,6
ToD	Discretized time of day (15 min)	1,2,3…96
$driver_{t-j}$	Driver for the last 5 rides to L_n	Mom, Dad
ϕ	Driver distribution model	[0,1]

- Labeling and weighting
- Weighted decision tree (LWDT)

Predicting Drivers (2)

- Accuracy
- Sliding window
    - 1 week: 72.1 %
    - 4 weeks: **87.7 %**

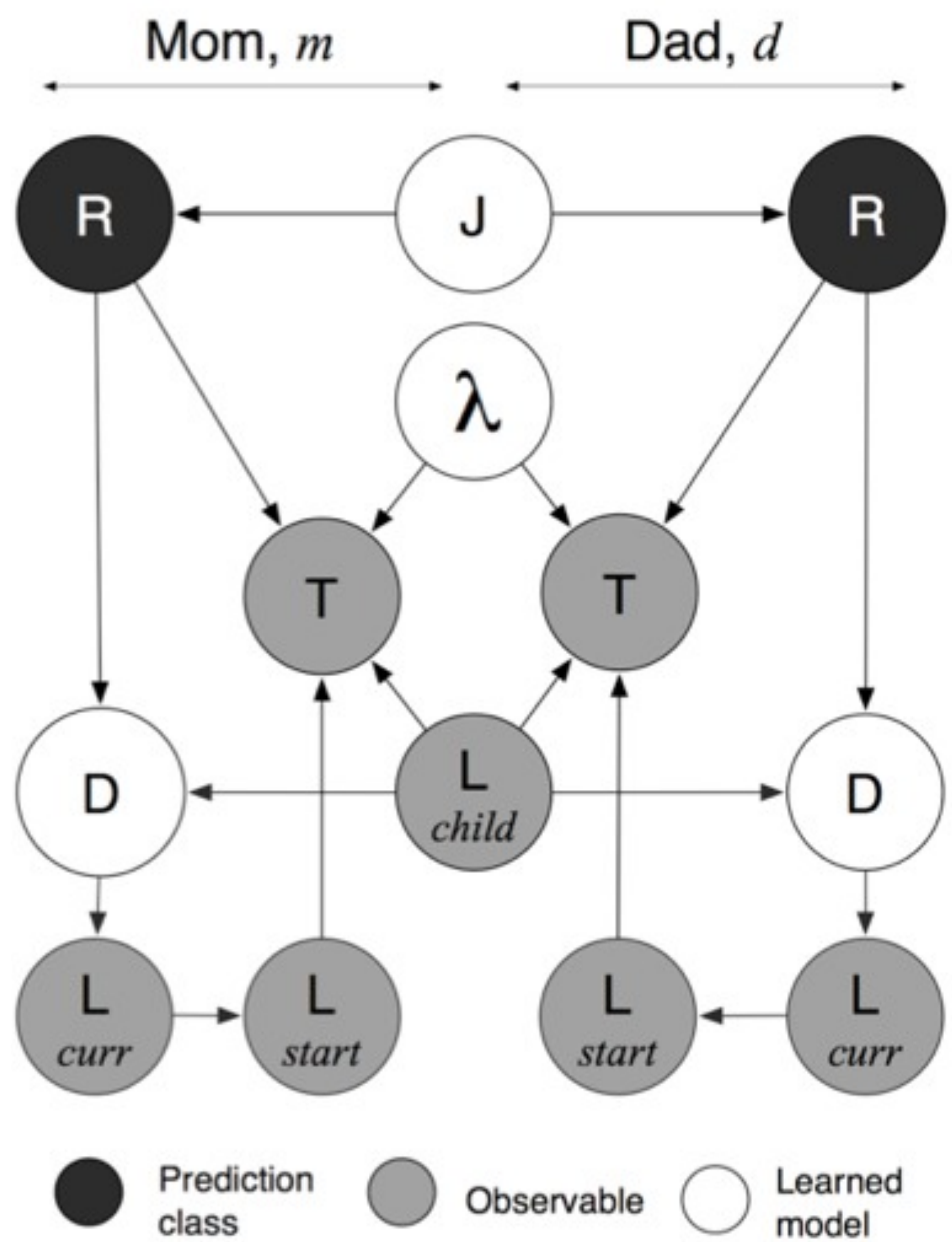
Forgetting Children (1)

- 10 minutes late
- Features

Name	*Meaning*	*Values*
R	Whether the parent remembers	True, False
J	Driver prediction model	Mom, Dad
T	If the parent is traveling	True, False
λ	*Empirical cumulative distribution(ecdf)* of on-time arrivals to L_{child} at time $T_{now}T_{ideal}$	[0,1]
L_{child}	Location of the child	Place ID
L_{start}	Starting location of a parent	Place ID
L_{curr}	Ending location of a parent	Place ID
D	Destination of a parent	Place ID

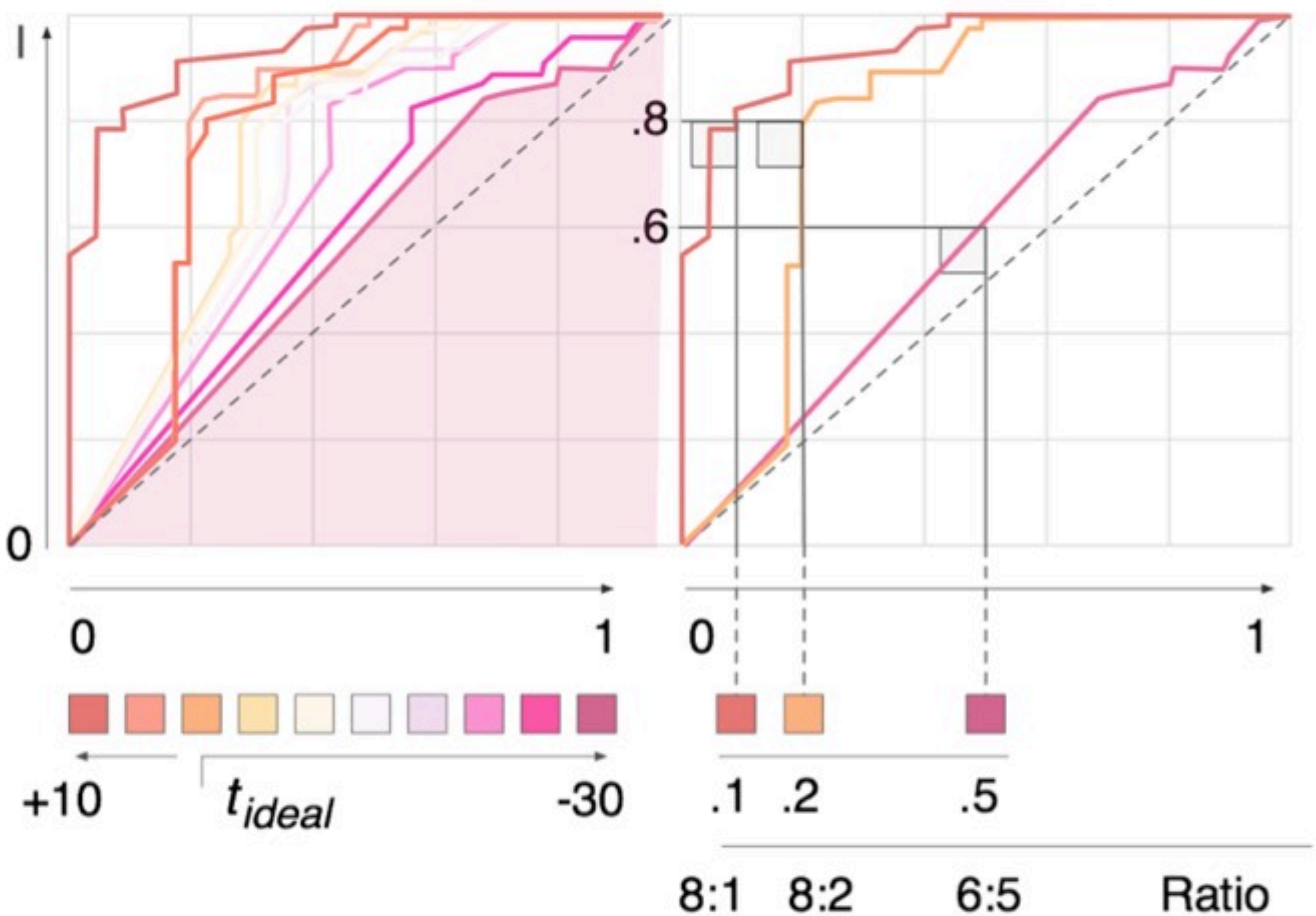
Forgetting Children (2)

Bayesian Network



Forgetting Children (3)

ROC (Receiver Operating Characteristic)



Optimizations

- Increase GPS rates
- Other modes of transport
  - other than one parent, one child, one car
- Better driver prediction model
  - “only “ 70 - 85 %

Future Potential

- Awareness Systems
- Calendars
- Reminder Systems

Unremarkable Computing

Intention

- Analyze home / domestic life routines
- Make technology “invisible in use”

Scenarios

- Door as a means of communication
  - Knocking, opening, context dependent
- Alarm clock becomes routine
  - Failure would be noted
- Routines are unknown to yourself
  - Can be noted by others

Conclusions (1)

Invisibility in use

$\neq$

perceptual invisibility

Conclusions (2)

Augment the action not

artifacts per se

Conclusions (3)

Support the doing without description of activities

Thanks for your attention

Questions / Discussion

- Use of more sensors?
- Potential of routine detection algorithms?
  - T-Patterns
  - Eigenbehaviors
  - Topic Models
- Data collection and children?