FINDING PATTERNS IN TEMPORAL DATA

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27th HCIL Symposium
May 27, 2010

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TEMPORAL CATEGORICAL DATA

- A type of time series

Numerical

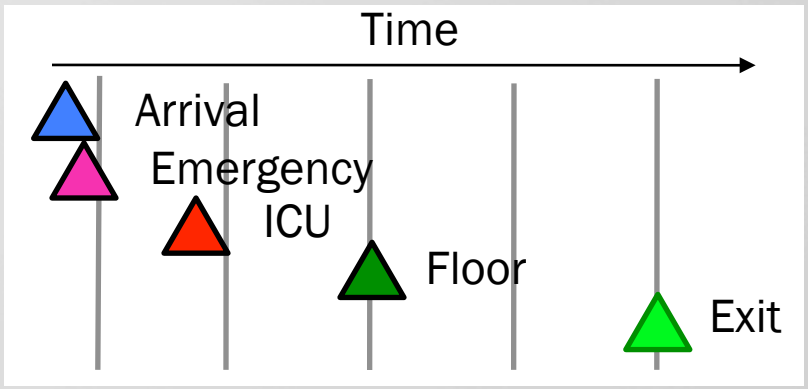
Event

Stock: Microsoft	
04/26/2010 10:00	31.03
04/26/2010 10:15	31.01
04/26/2010 10:30	31.02
04/26/2010 10:45	31.08
04/26/2010 11:00	31.16

Category

Event

Patient ID: 45851737	
12/02/2008 14:26	Arrival
12/02/2008 14:36	Emergency
12/02/2008 22:44	ICU
12/05/2008 05:07	Floor
12/14/2008 06:19	Exit



TEMPORAL CATEGORICAL DATA

Electronic Health Records: symptoms, treatment, lab test

Traffic incident logs: arrival/departure time of each unit

Student records: course, paper, proposal, defense, etc.

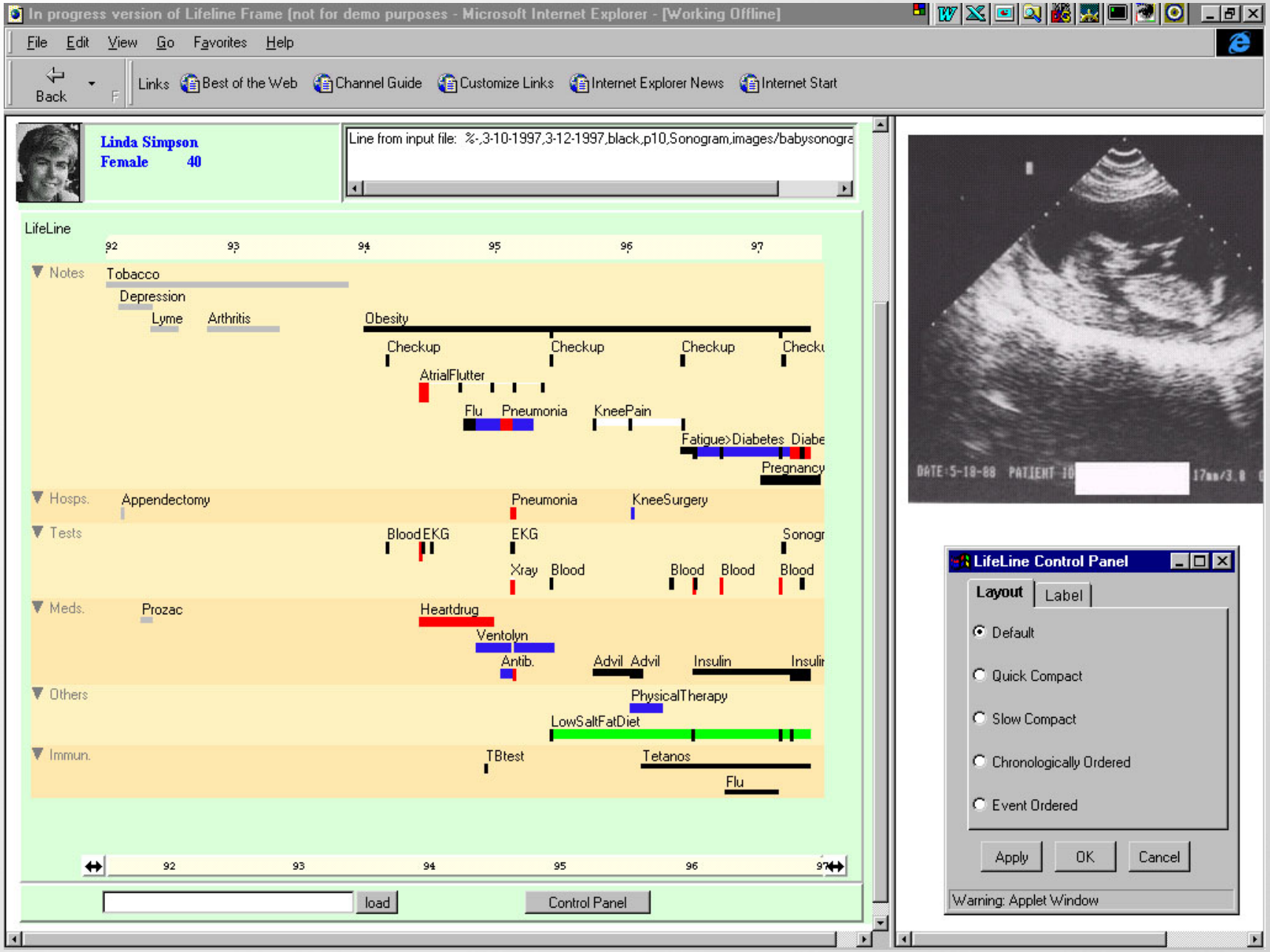
Others: web logs, usability study logs, etc.

10+ years work on temporal visualization

(mostly on Electronic Health Records)

LIFELINES

[Plaisant et al. 1998]
http://www.cs.umd.edu/hcil/lifelines



LifeLines – Single Patient

WORKING WITH PHYSICIANS AT

WASHINGTON HOSPITAL CENTER

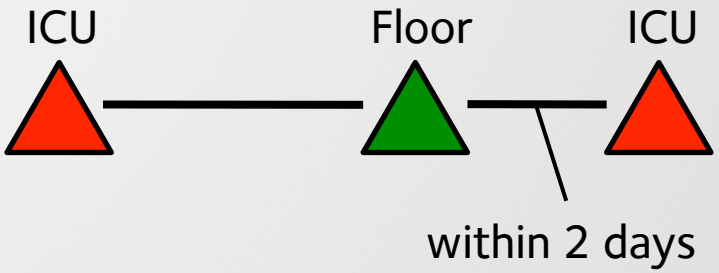
EXAMPLE DATA

- Patient transfers

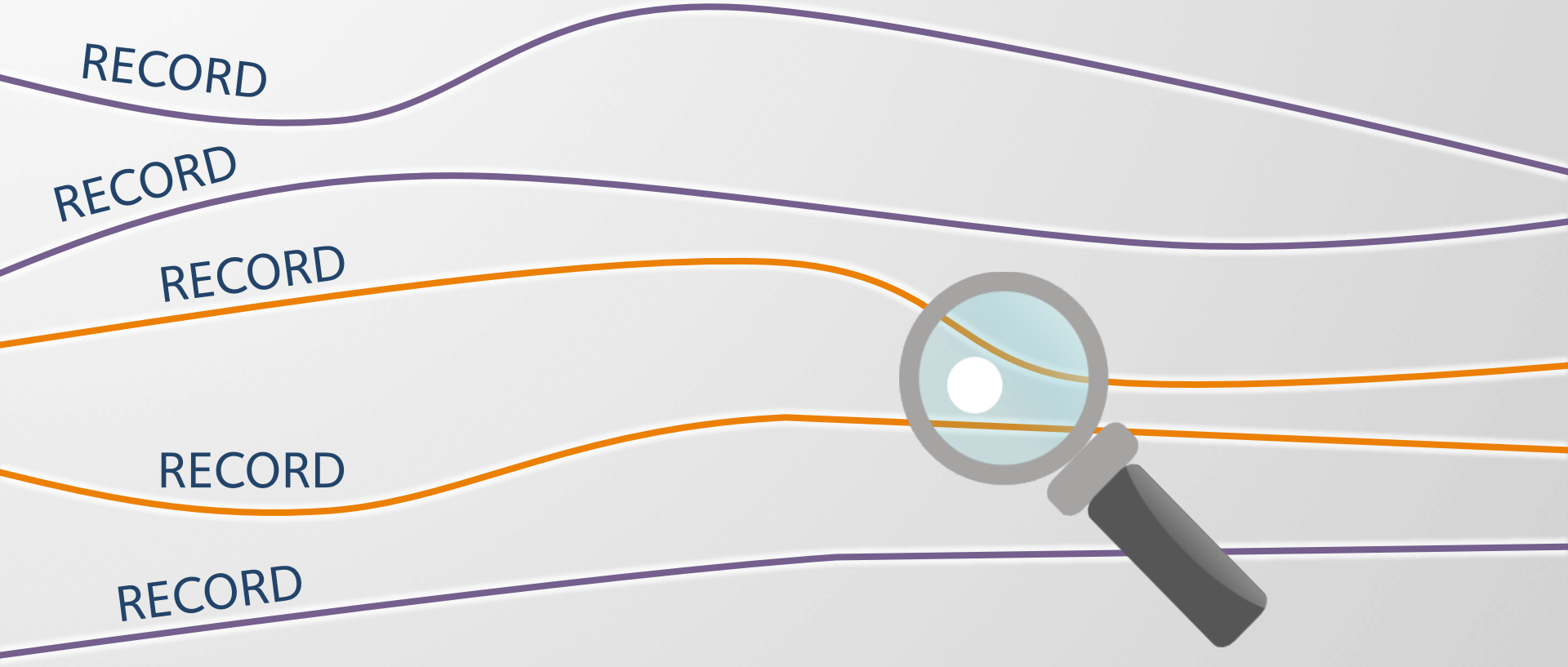
	**ARRIVAL**	Arrive the hospital
	**EMERGENCY**	Emergency room
	**ICU**	Intensive Care Unit
	**INTERMEDIATE**	Intermediate Medical Care
	**FLOOR**	Normal room
	**EXIT-ALIVE**	Leave the hospital alive
	**EXIT-DEAD**	Leave the hospital dead

TASKS

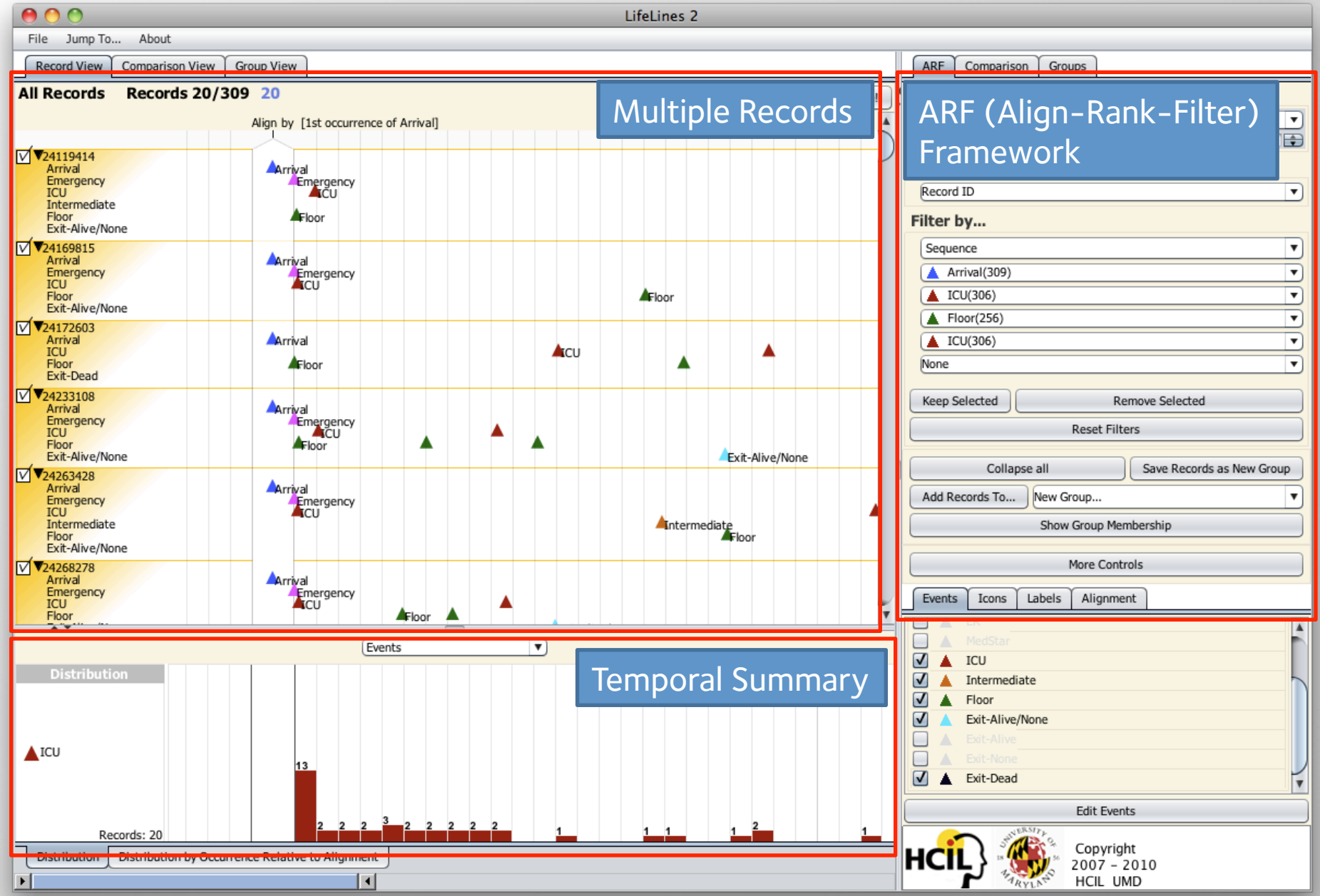
- Example: Finding “Bounce backs”



LIFELINES 2



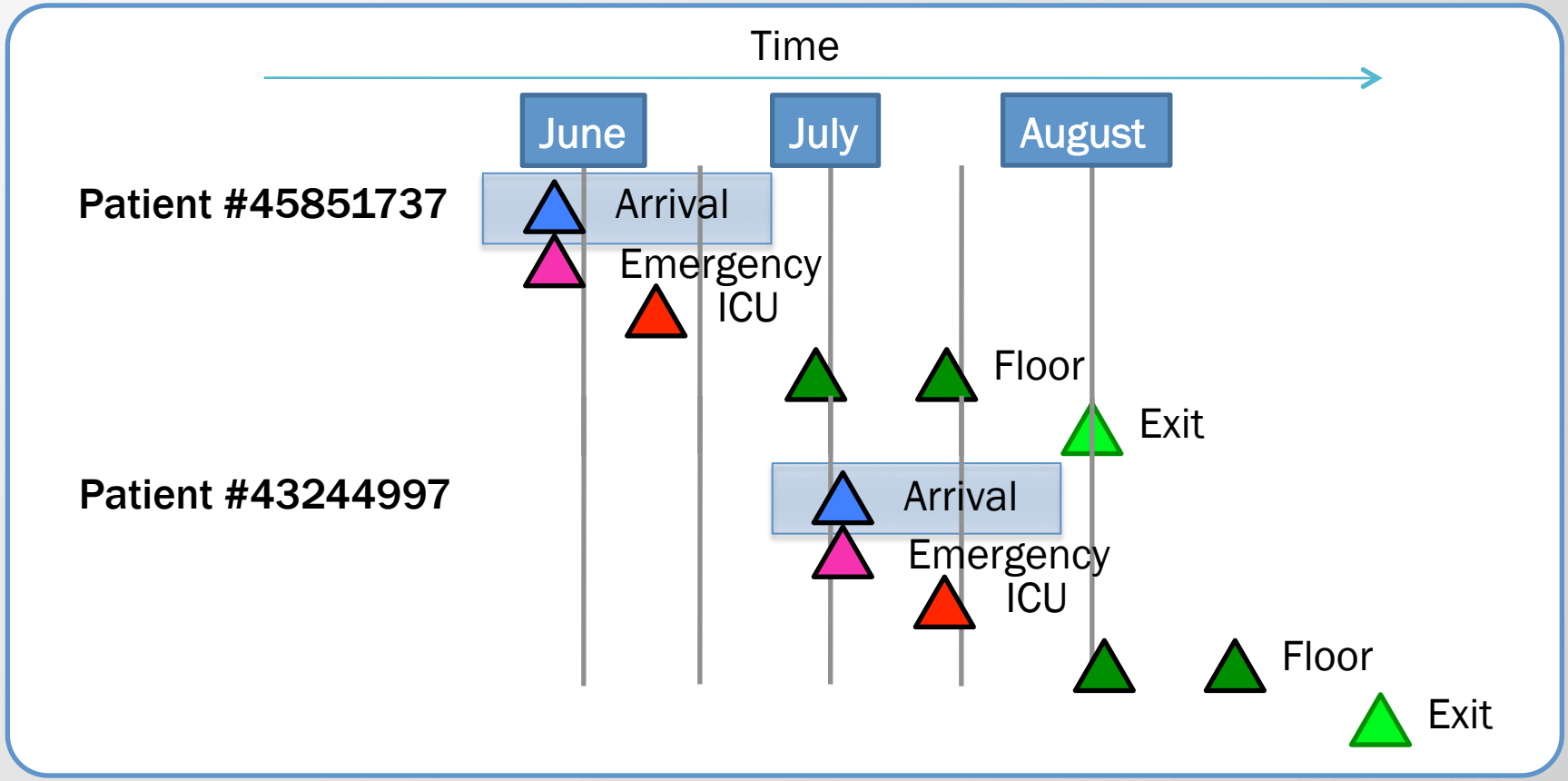
[Wang et al. 2008, 2009]
http://www.cs.umd.edu/hcil/lifelines2



LifeLines2 – Search and Visualize

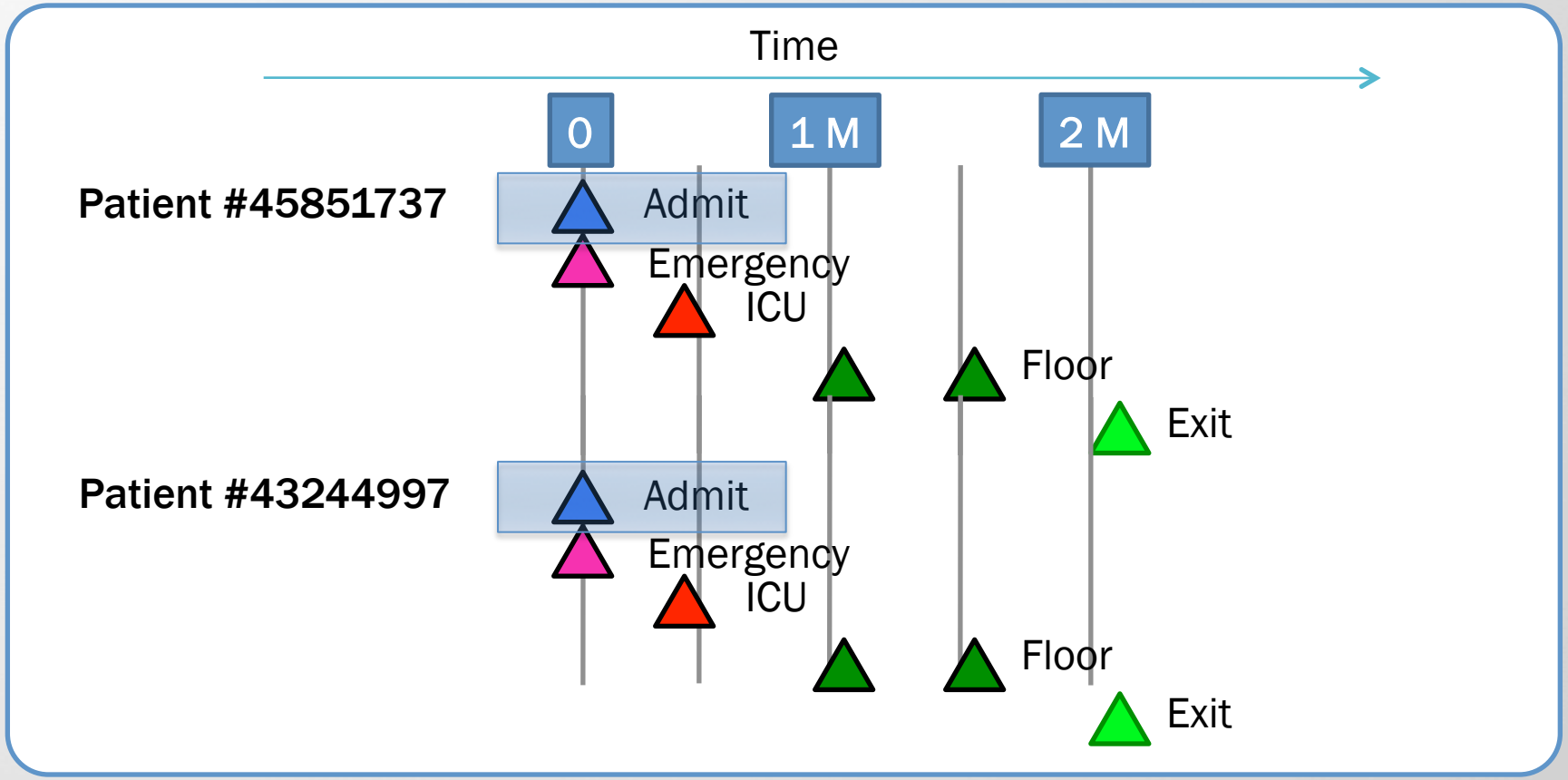
ALIGNMENT

- Sentinel events as reference points

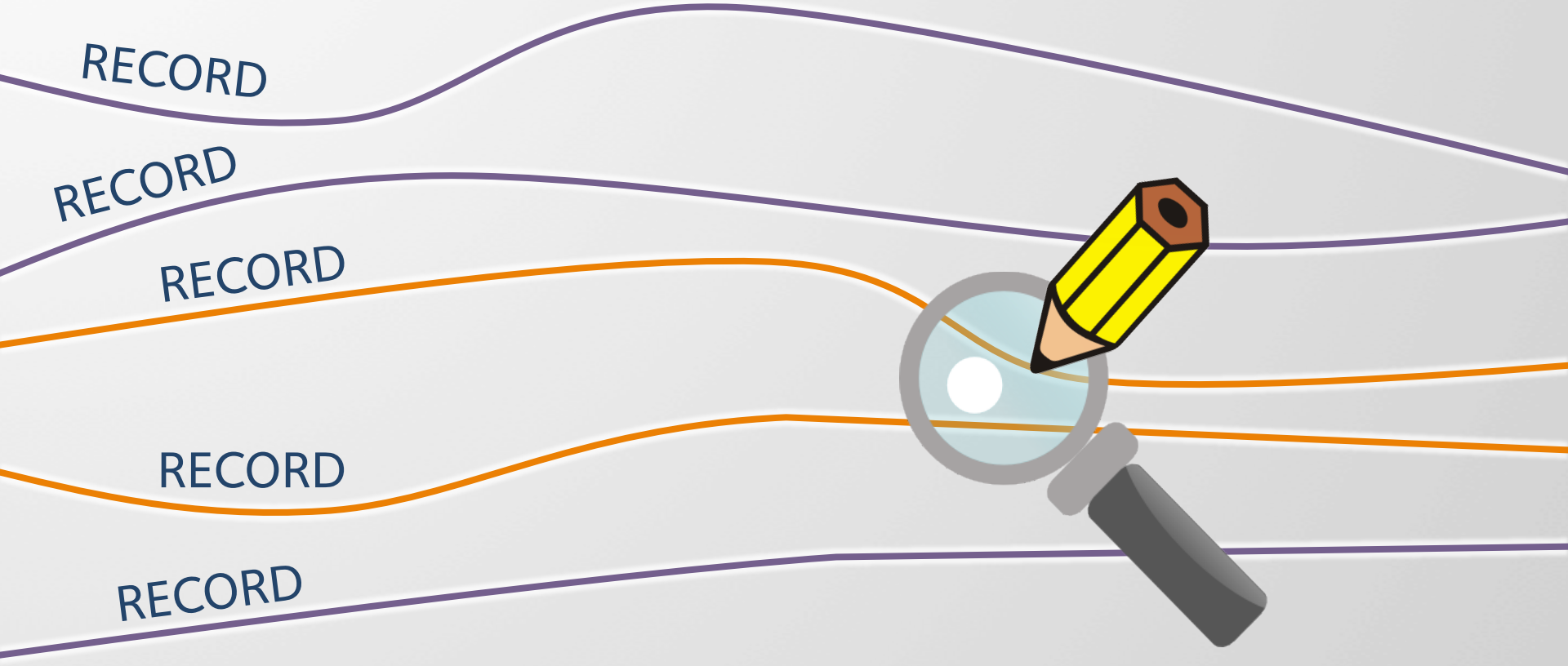


ALIGNMENT (2)

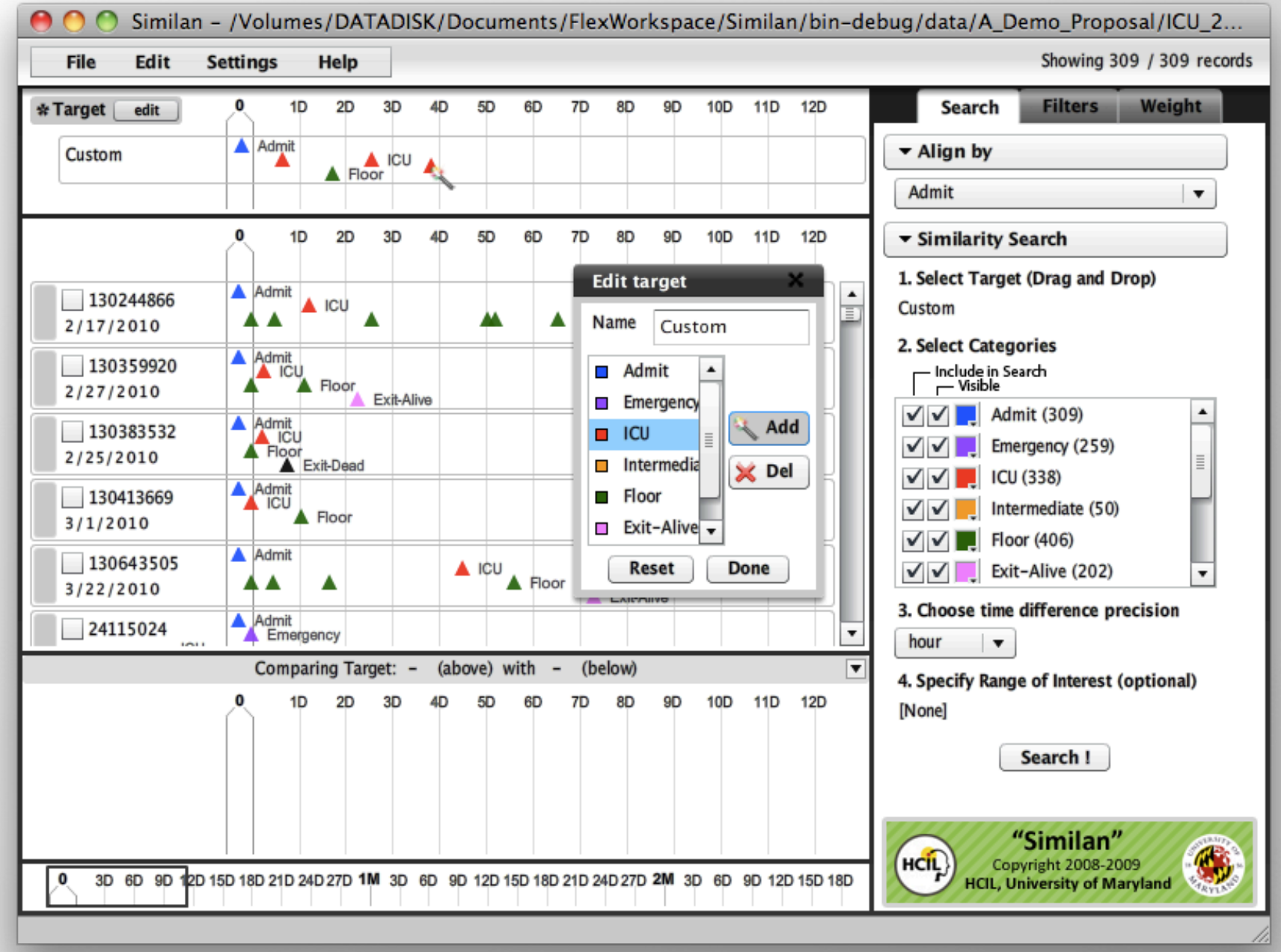
- Time shifting



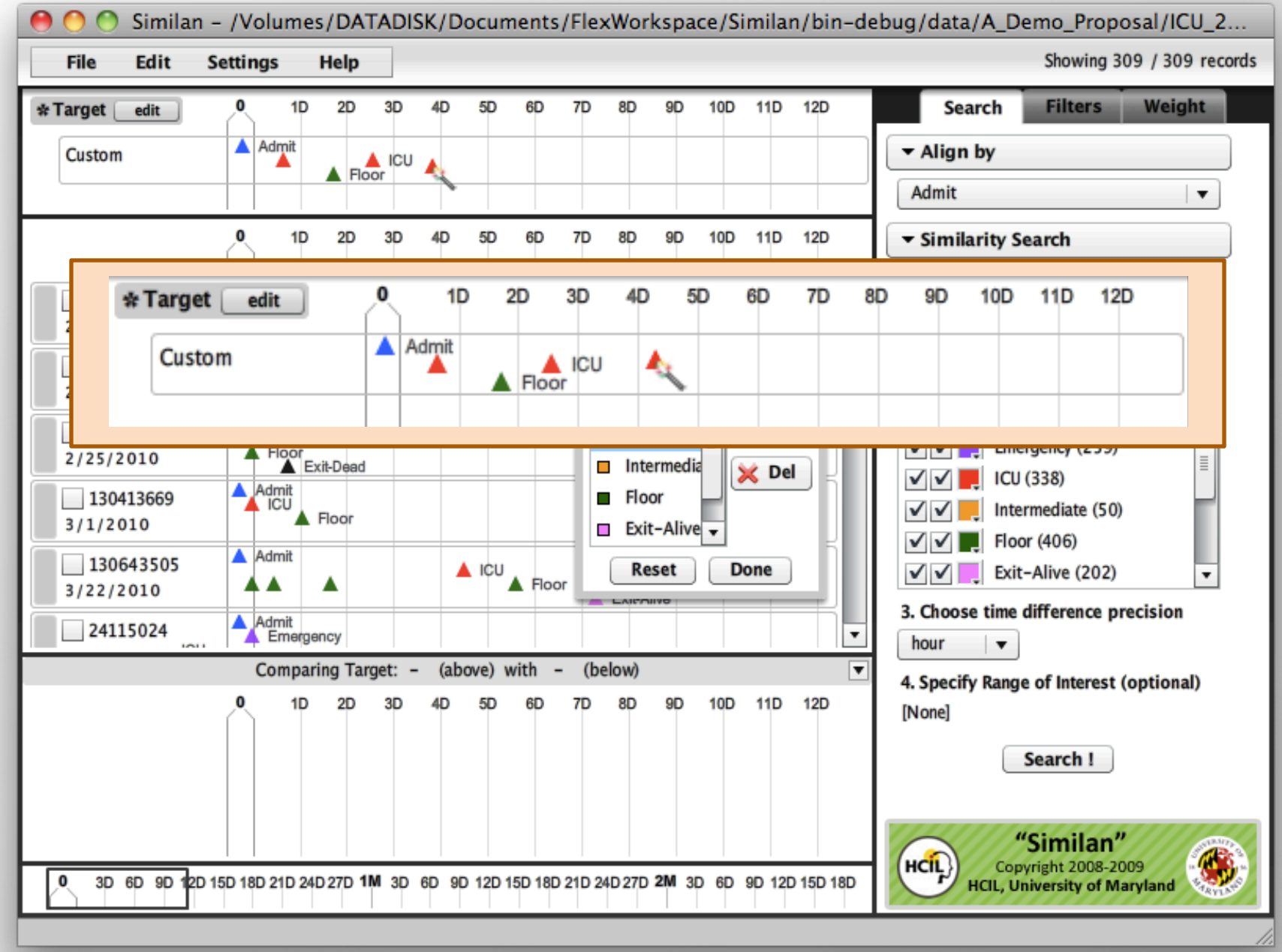
SIMILAN



[Wongsuphasawat & Shneiderman 2009]
http://www.cs.umd.edu/hcil/similan



Similan – Search by Similarity

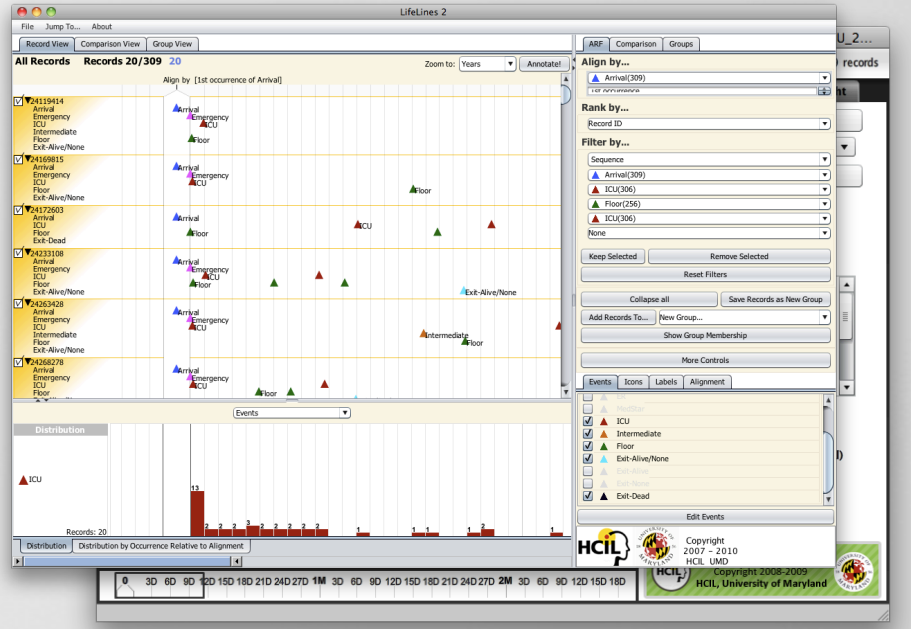


Similan – Search by Similarity

FINDING “BOUNCE BACKS”

Before

After



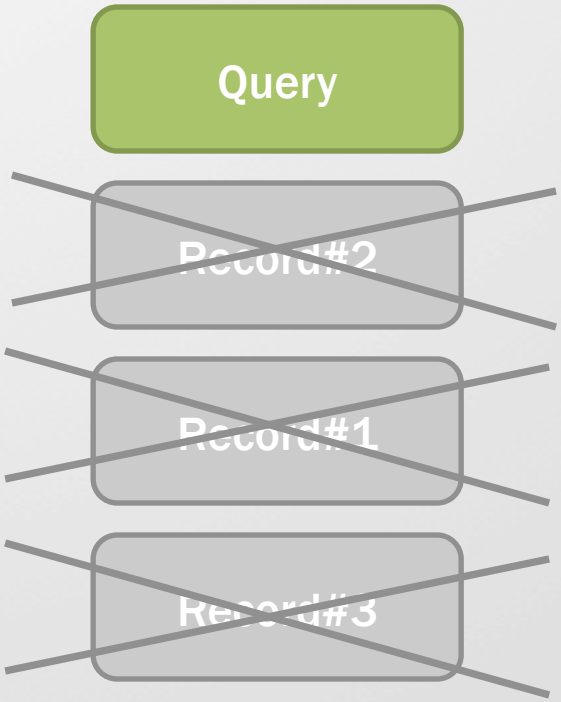
- Much faster to specify new query
- Visualizing the results gives better understanding

USER STUDIES: SEARCH

LIFELINES2

Exact

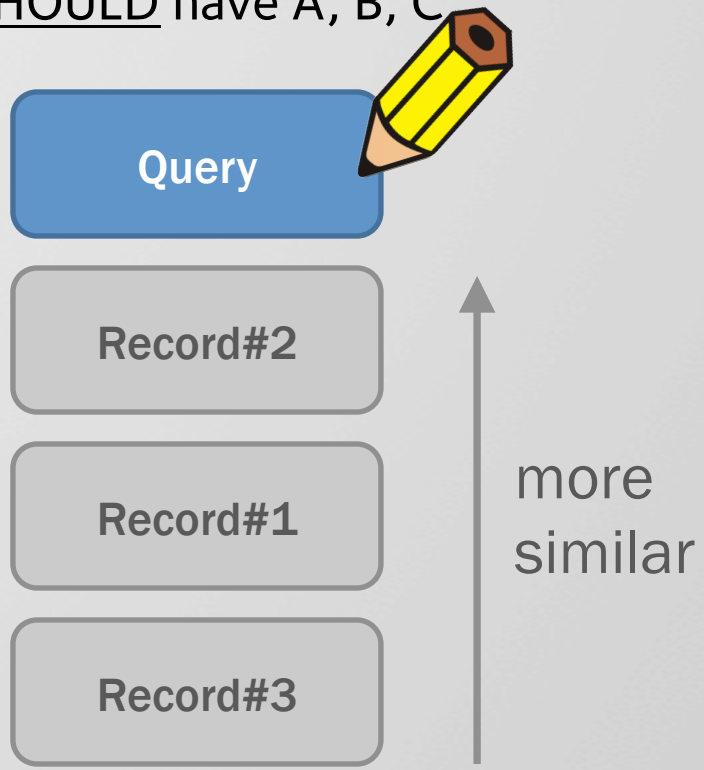
MUST have A, B, C



SIMILAN

Similarity-based

SHOULD have A, B, C

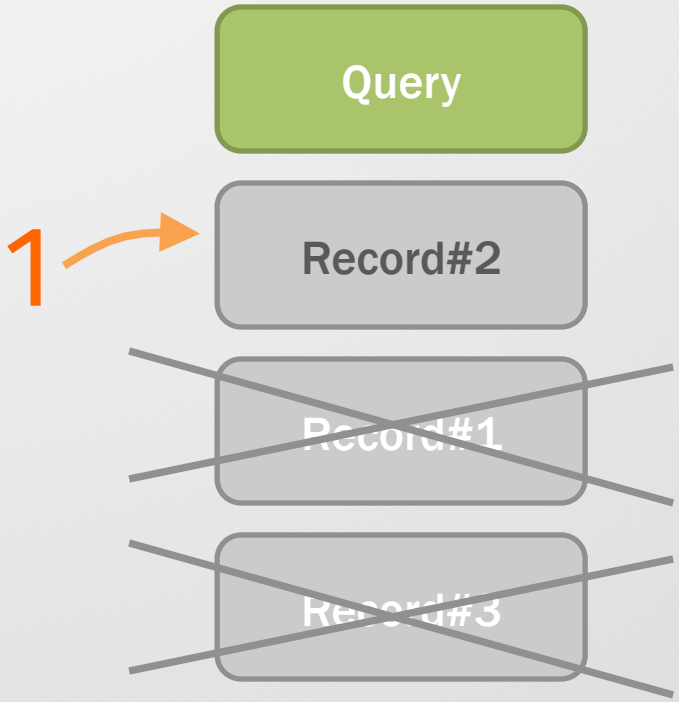


USER STUDIES: SEARCH

LIFELINES2

Exact

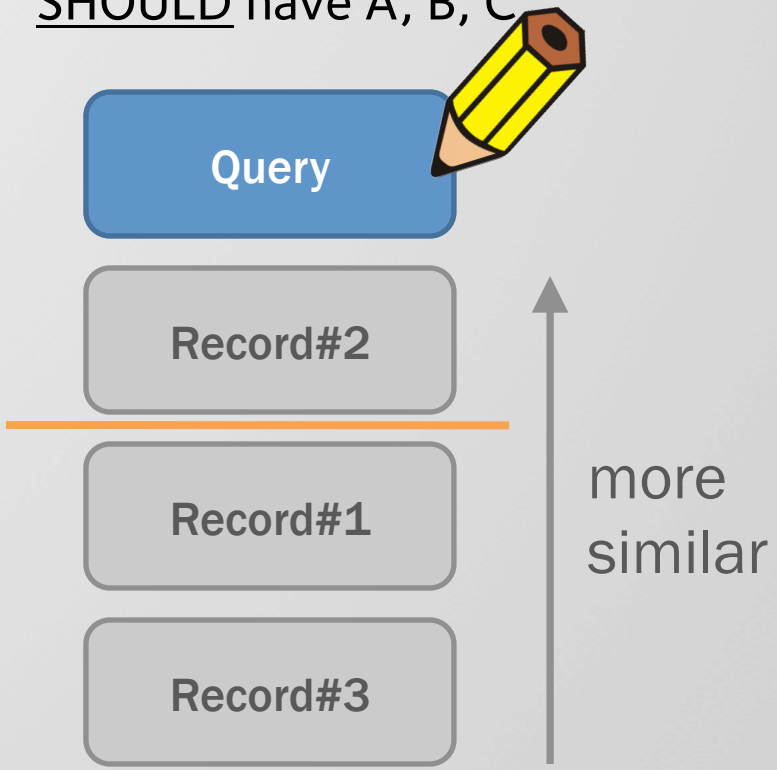
MUST have A, B, C



SIMILAN

Similarity-based

SHOULD have A, B, C

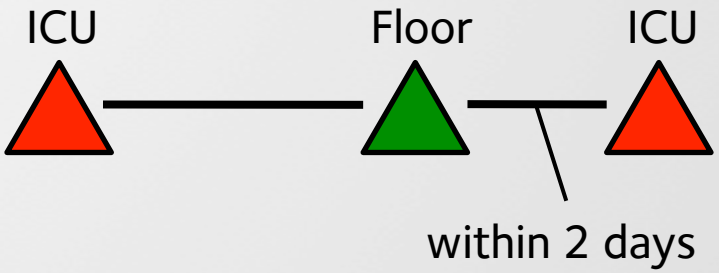


NEW STUFF

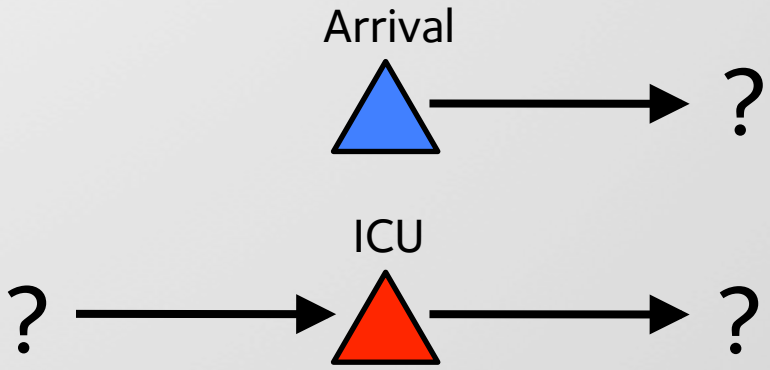
Needs for an overview -> LifeFlow!

TASKS

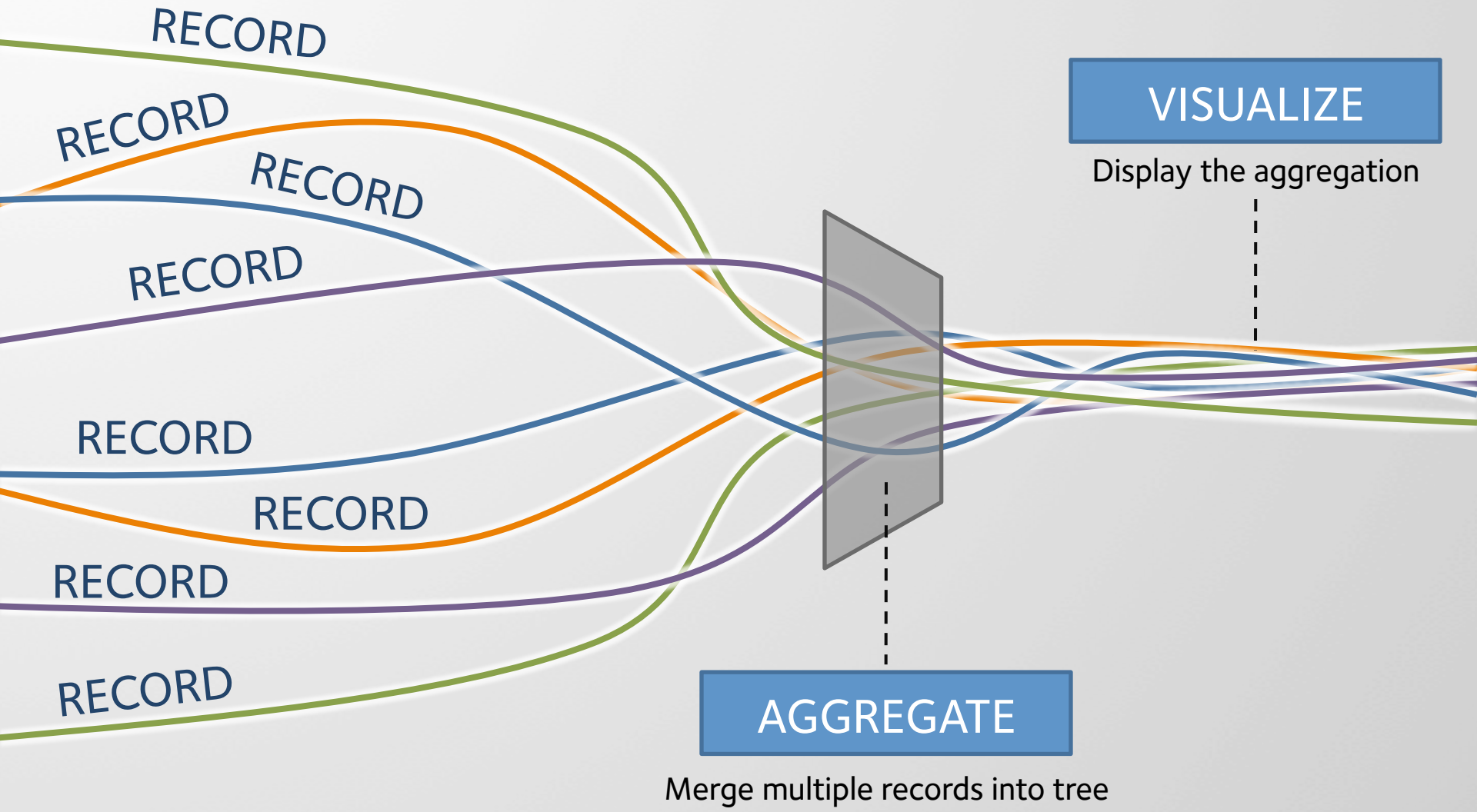
- Example: Finding “Bounce backs”



- Other questions

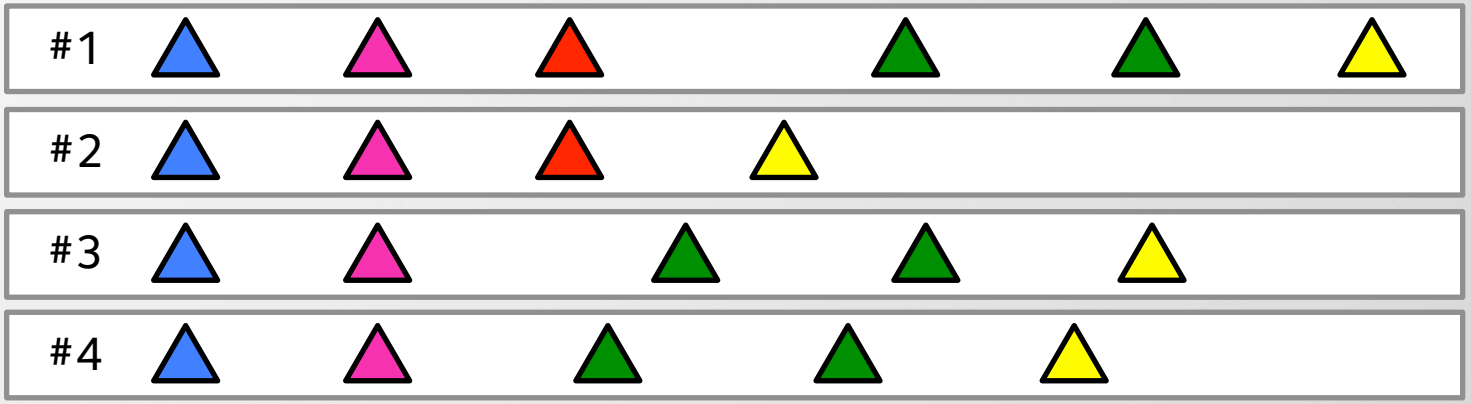


LIFEFLOW


RECORD
RECORD
RECORD
RECORD
RECORD
RECORD
RECORD
RECORD
VISUALIZE
Display the aggregation
AGGREGATE
Merge multiple records into tree

AGGREGATE

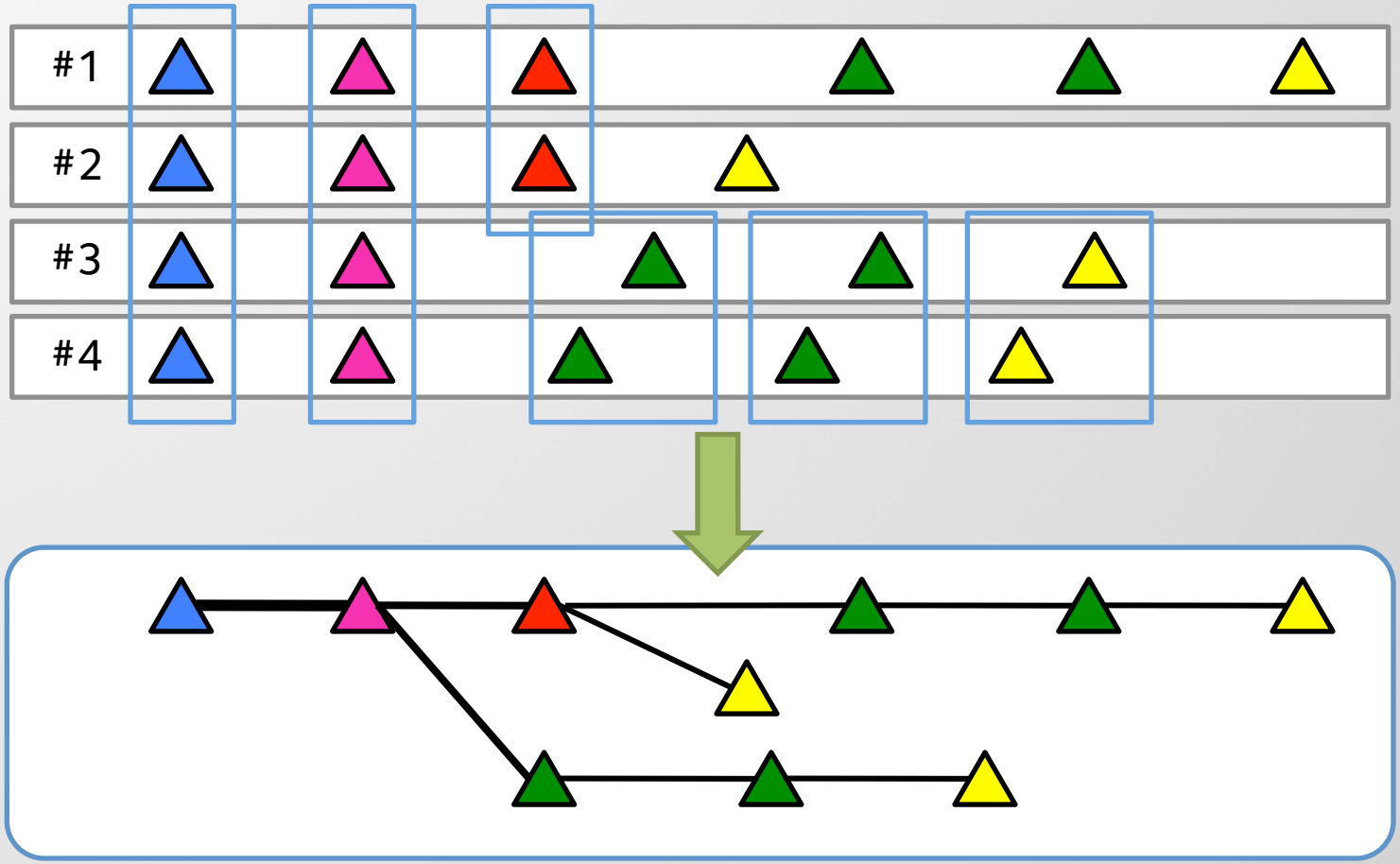
- Aggregate by prefix



Example with 4 records

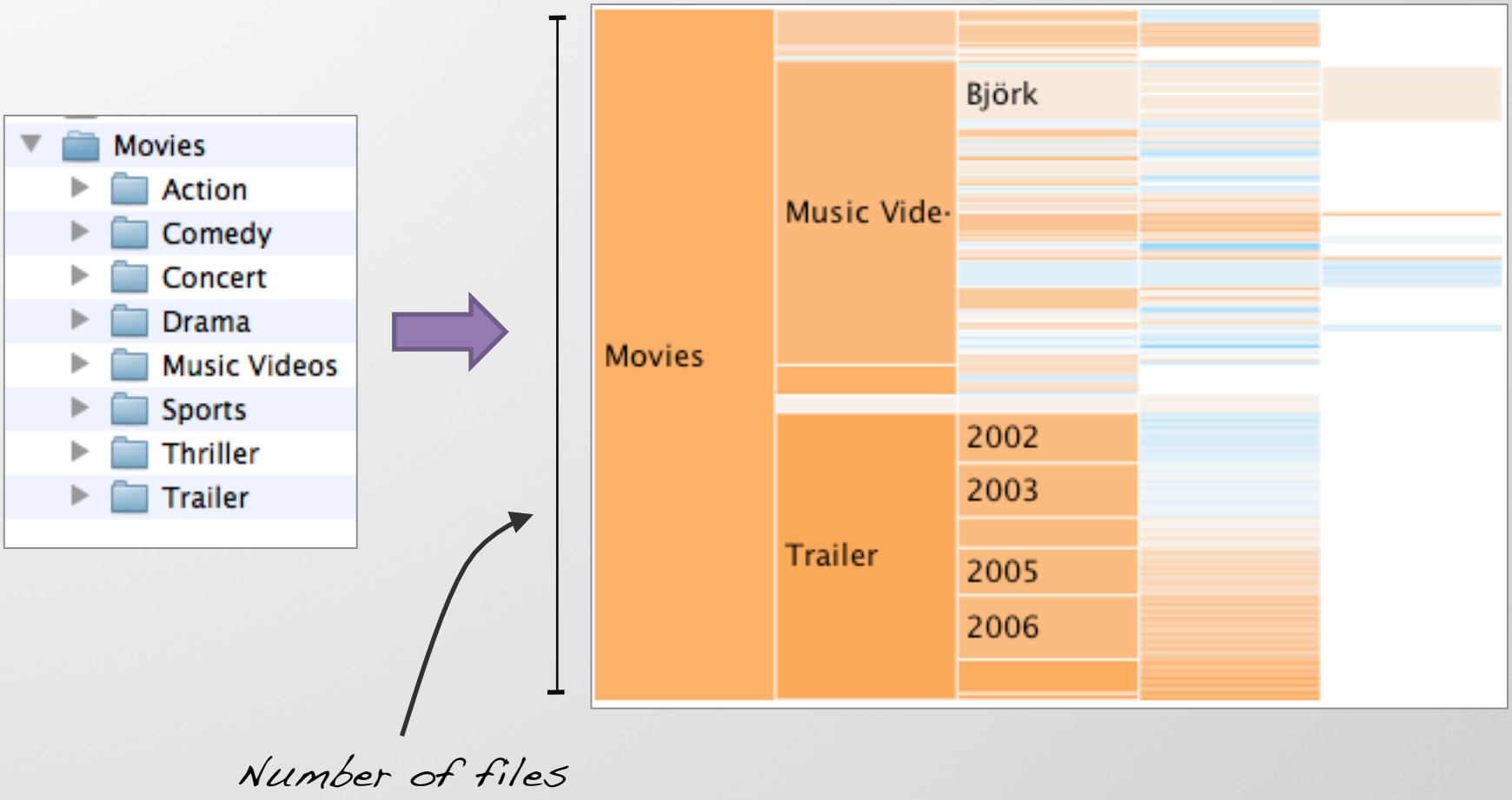
AGGREGATE

- Aggregate by prefix



VISUALIZE

- Inspired by the Icicle tree [Fekete 2004]



VISUALIZE (2)

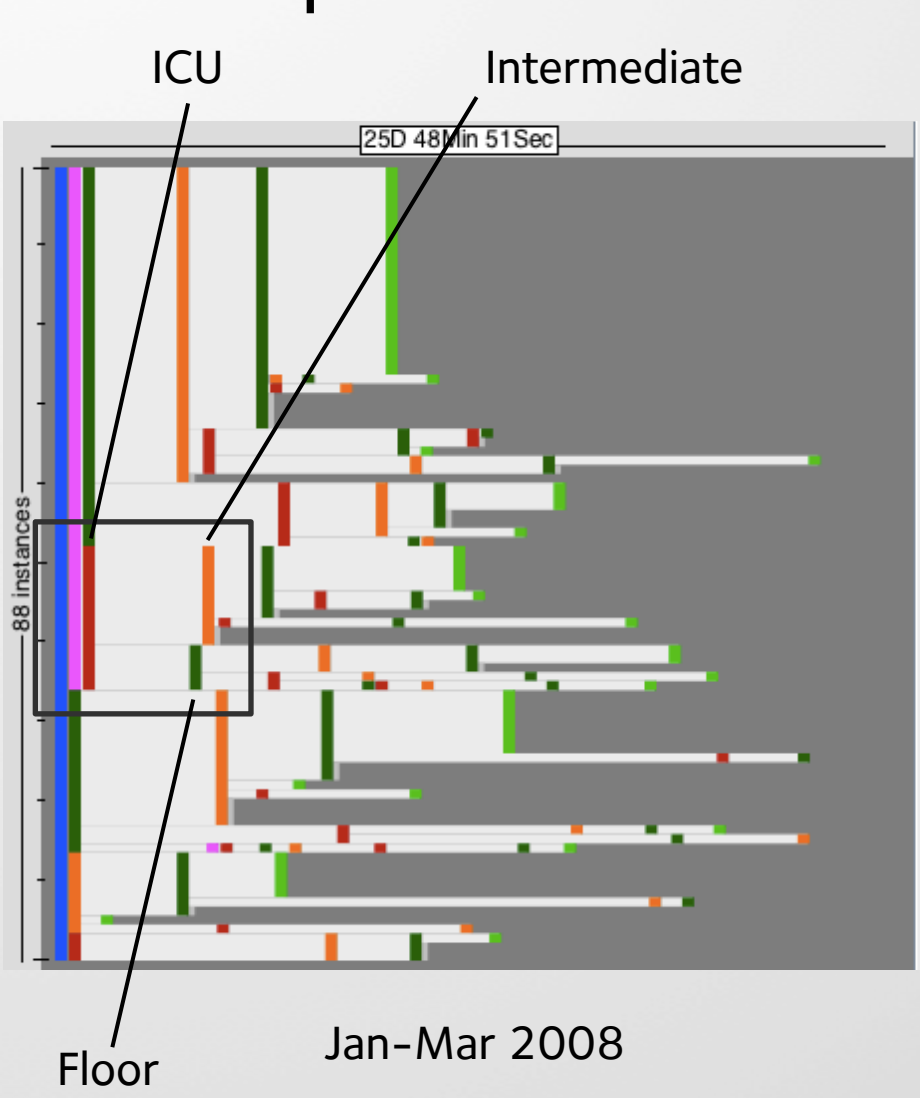
- Use horizontal axis to represent time
- Video

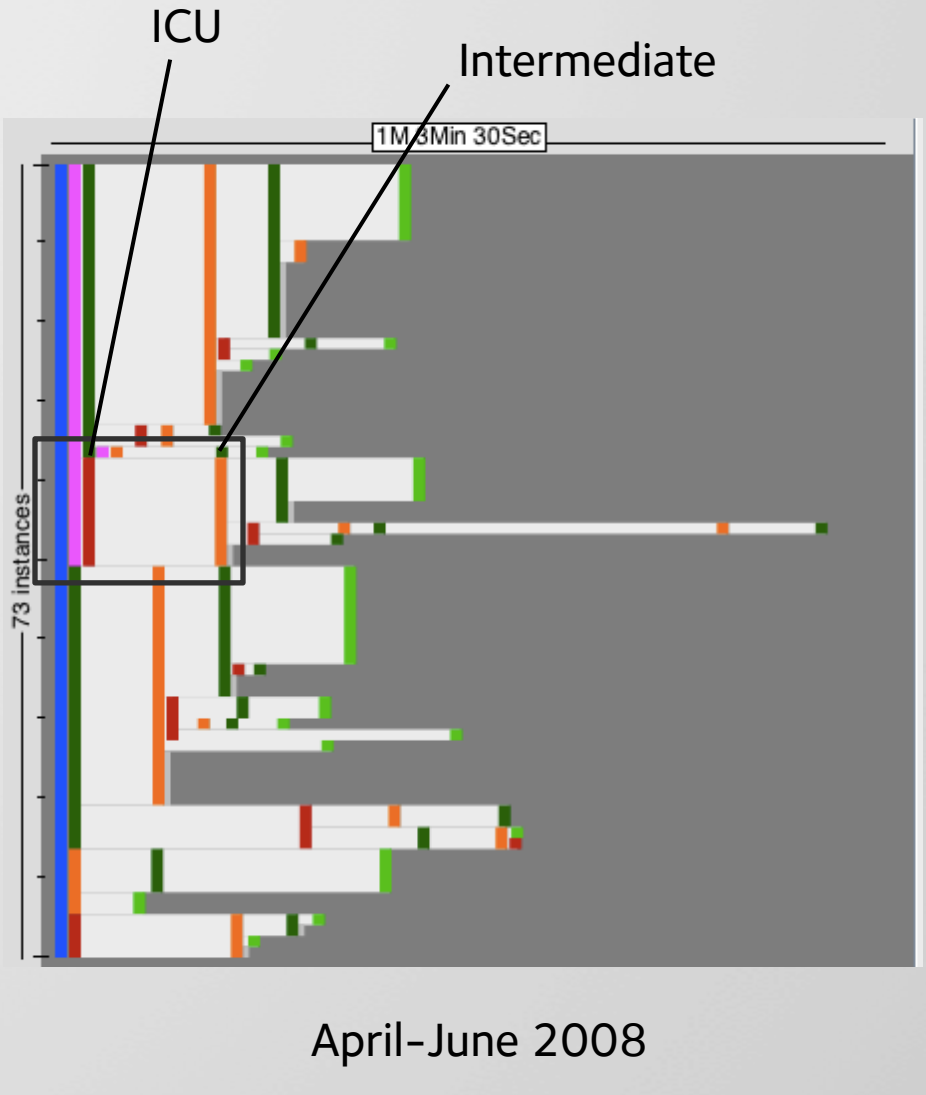
DEMO – LIFEFLOW

When the lines are combined into flow

FUTURE WORK

- Comparison





TAKE-AWAY MESSAGE

Information visualization is a powerful way to explore temporal patterns.

You can work with us on new case studies.