



LifeFlow:

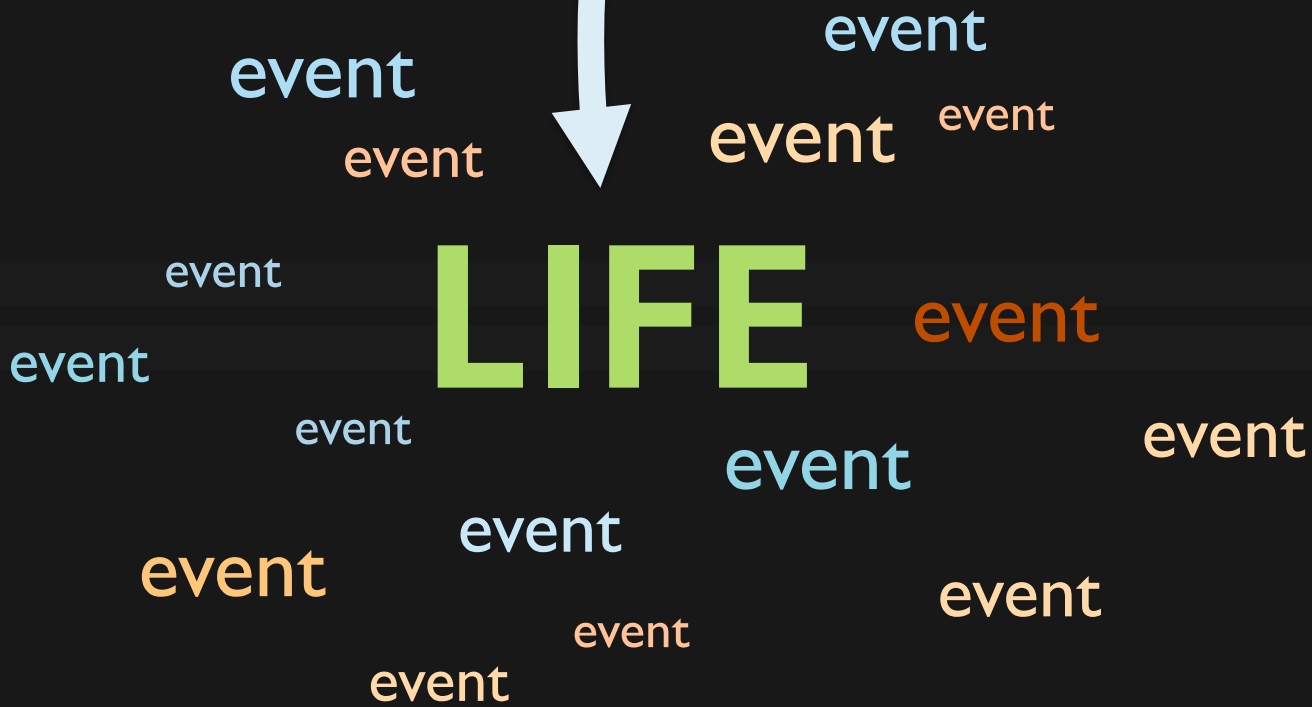
Visualizing an Overview
of Event Sequences

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CHI 2011
vancouver, bc

<http://www.cs.umd.edu/hcil/lifeFlow>



Time Event type



(7:00 am, Wake up)

event

event

event

event event

LIFE

event

event

event

event

event

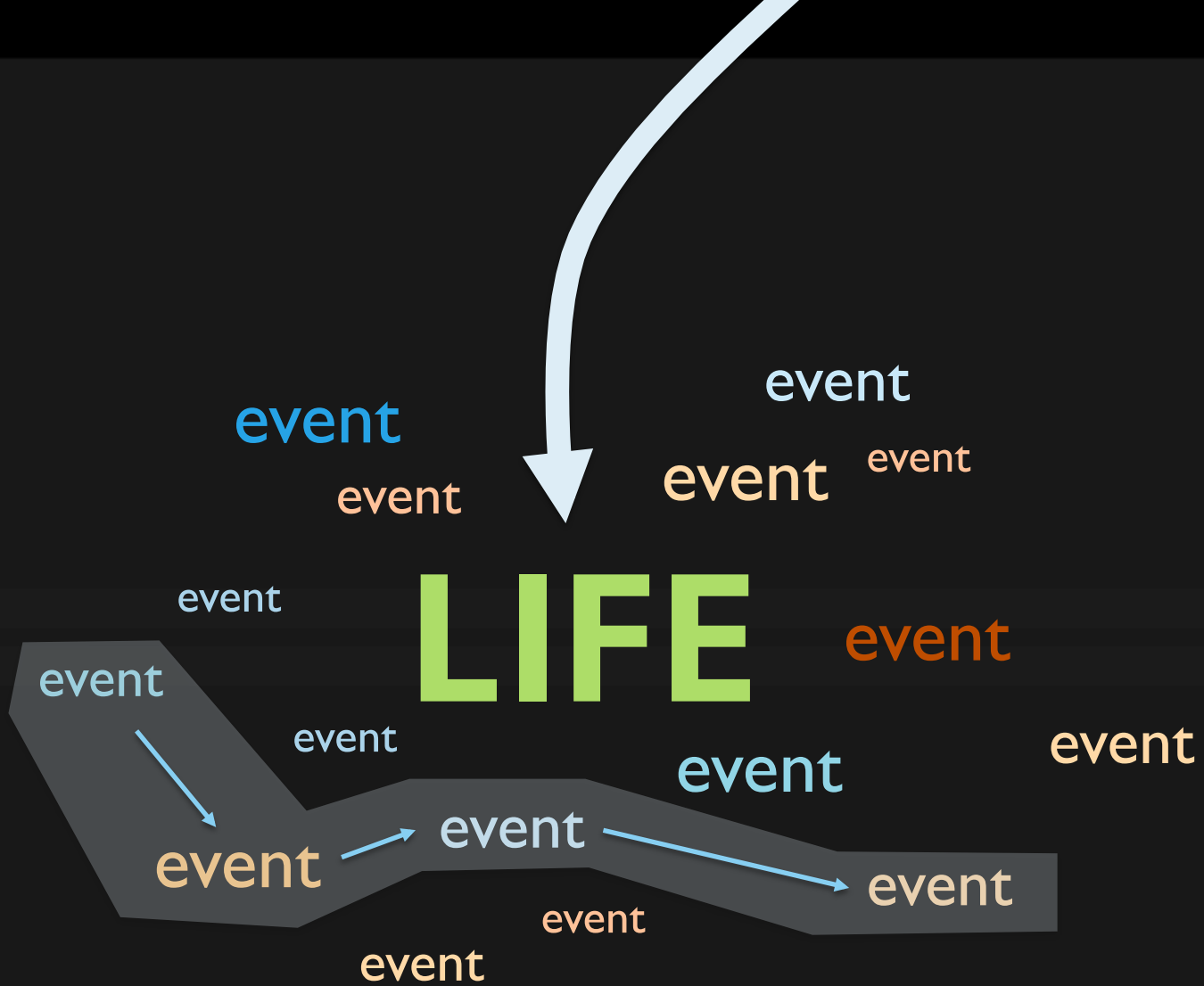
event

event

event

event

event



“Event Sequence”

Human Activities



(7:00 am, Wake up)



(7:10 am, Shower)



(7:30 am, Breakfast)

Traffic Incidents Logs



(9:30 am, Notification)



(9:55 am, Units arrived)



(10:30 am, Scene cleared)

Event Sequences



Human Activities



Electronic Health Records



Traffic Incident Logs



Usability Study Logs



Web logs

and more...









Physicians at Washington Hospital Center



Electronic Health Records

- E.g. patient transfers in the hospital
- Event types:

	ARRIVAL	Arrive the hospital
	EMERGENCY	Emergency room
	ICU	Intensive Care Unit
	FLOOR	Normal room
	DISCHARGE-ALIVE	Leave the hospital alive
	DIE	Leave the hospital dead

Improve the Quality of Care

Patient ID: 45851733

Patient ID: 45851732

Patient ID: 45851731

1		
1	1	
1	1	
1	1	12/02/2008 14:26 Arrival
1	1	12/02/2008 14:26 Emergency
1	1	12/02/2008 22:44 ICU
1	1	12/05/2008 05:07 Floor
1	1	12/08/2008 10:02 Floor
1	1	12/14/2008 06:19 Discharge

Emergency Department

6,000+

patients per month

Visualizing event sequences

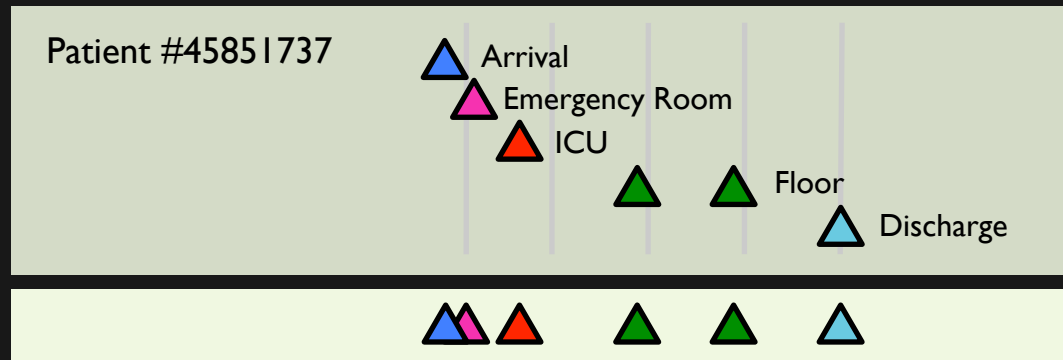
From one event sequence...

- Single record [Cousins91], [Harrison94], [Plaisant98], ...

Patient ID: 45851737		
12/02/2008	14:26	Arrival
12/02/2008	14:26	Emergency
12/02/2008	22:44	ICU
12/05/2008	05:07	Floor
12/08/2008	10:02	Floor
12/14/2008	06:19	Discharge

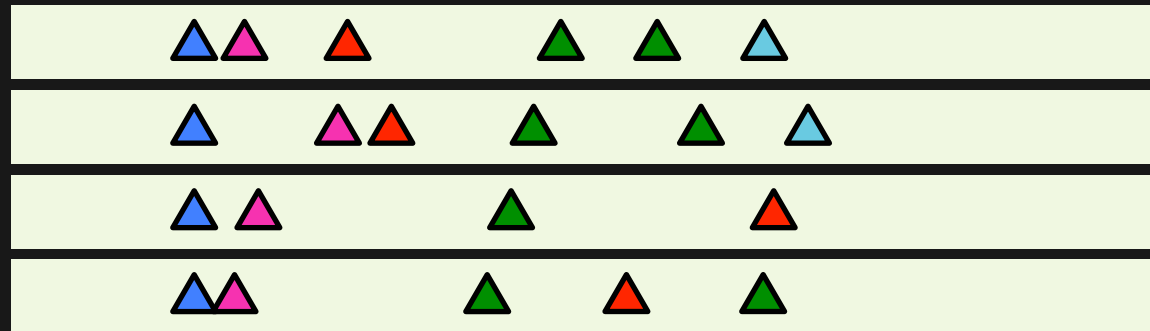


Time →



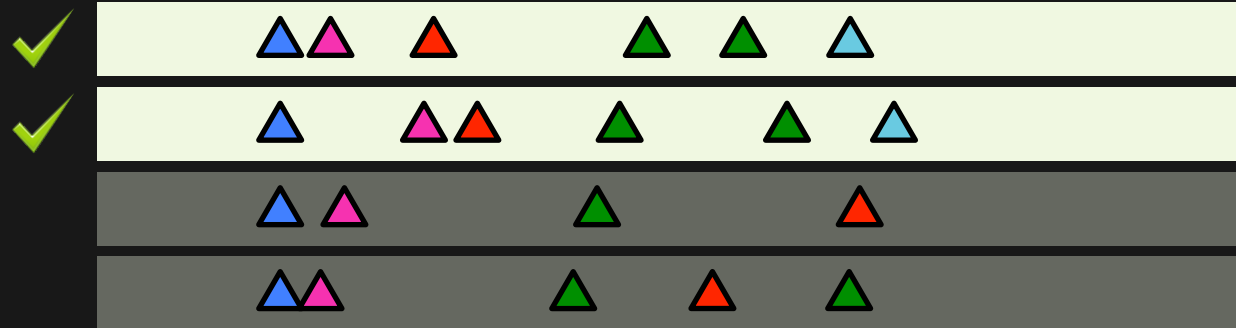
To multiple event sequences...

- Search [Fails06], [Wang08], [Vrotsou09], ...



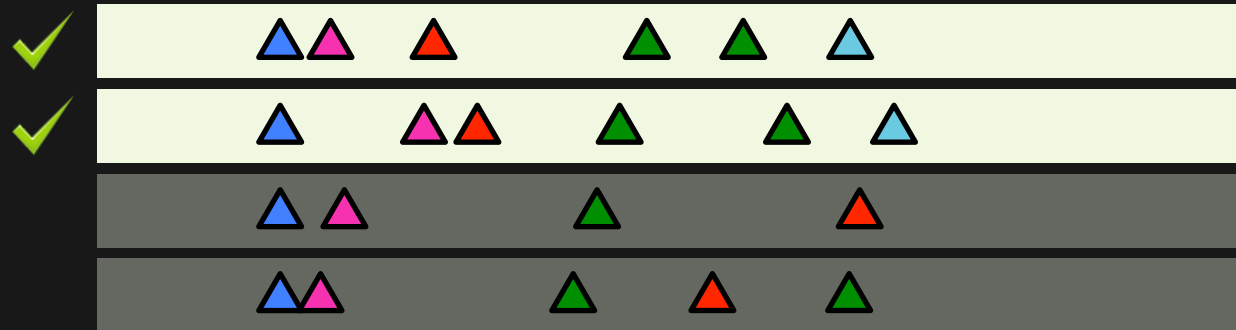
To multiple event sequences...

- Search [Fails06], [Wang08], [Vrotsou09], ...

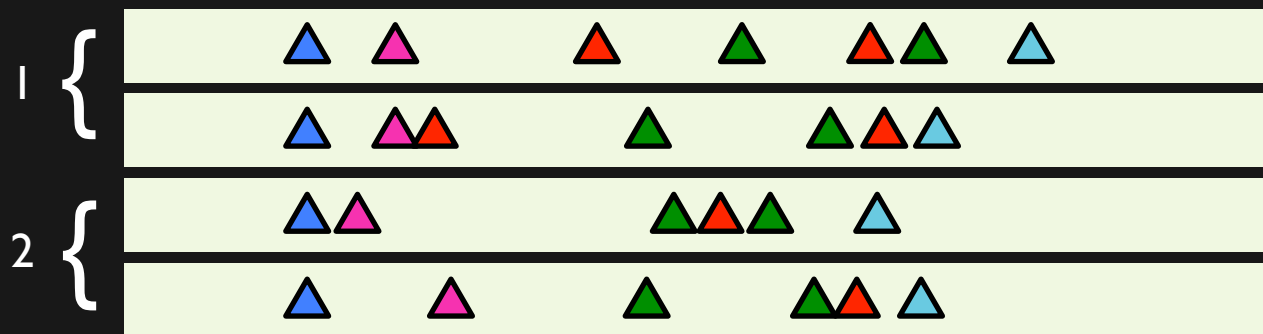


To multiple event sequences...

- Search [Fails06], [Wang08], [Vrotsou09], ...



- Group [Phan07], [Burch08], [Wang09], ...



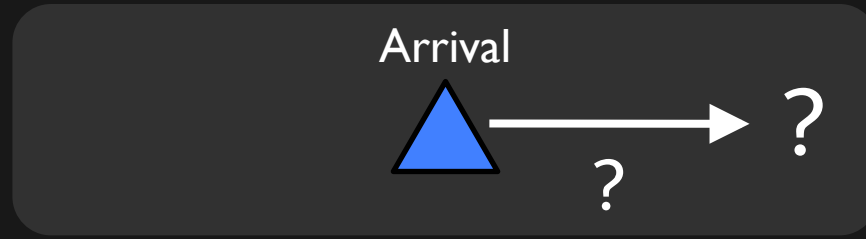
To multiple event sequences...

- Search
- Group

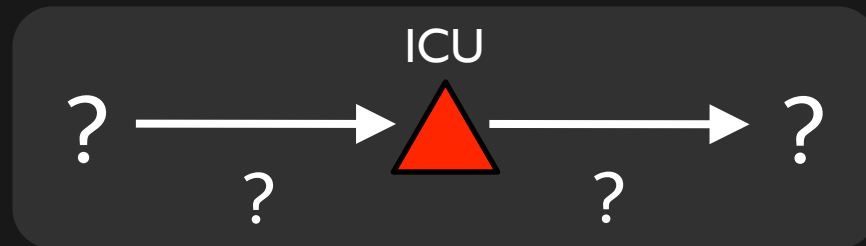
- Summarize?

Summarize

e.g. 1) What happened to the patients after they arrived?



2) What happened to the patients before & after ICU?



Overview / Summary

Millions of records

Challenges

- Display millions of records on one screen
 - Limited space (typical monitors)
 - Scalability (millions of records?)
 - Aggregation
- While preserve important information
 - What are all the possible sequences?
 - How long is the gap between each pair of events?



LIFEFLOW

Picture > 1000 words

LifeFlow > 1000 event sequences



LIFEFLOW

... is novel

... is scalable

... provides the missing overview

... summarizes all possible sequences
and time gap between events

LifeFlow:

Visualizing an Overview
of Event Sequences



VIDEO
LifeFlow Design

LifeFlow:

Visualizing an Overview
of Event Sequences



DEMO
LifeFlow Demonstration

Case Study# 1: Medical

6,000+

patients per month

Improve the Quality of Care

Feedback

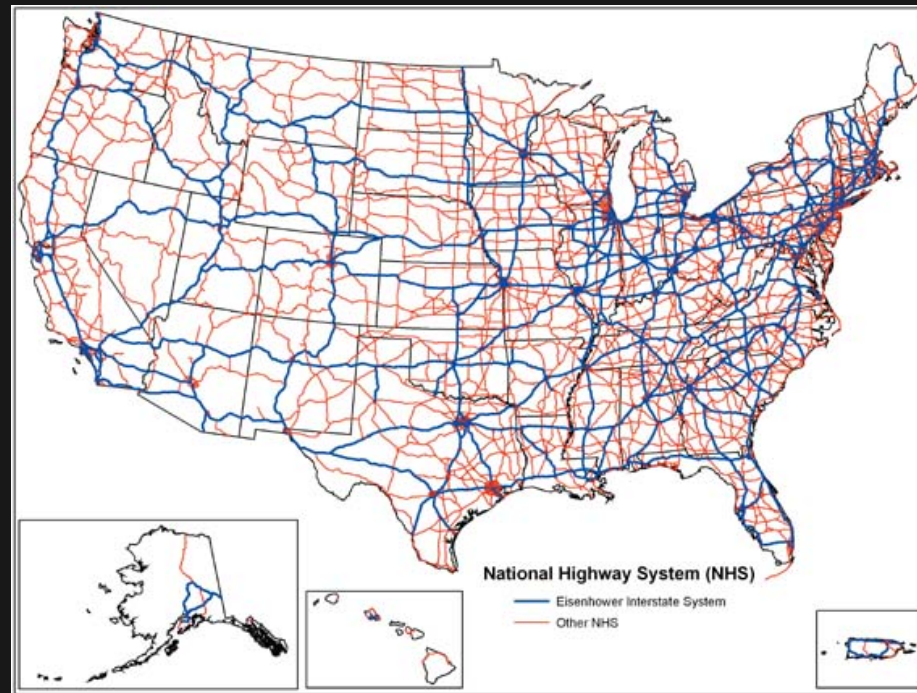
- Big picture + anomalies
- Less worry about query formulation, more time thinking about new questions
- Long-term monitoring

Case Study#2: Transportation

200,000+

traffic incidents

Compare traffic agencies



Measurement Tool

Zoom: 109 Years

Alignment

0 2Y 4Y 6Y 8Y

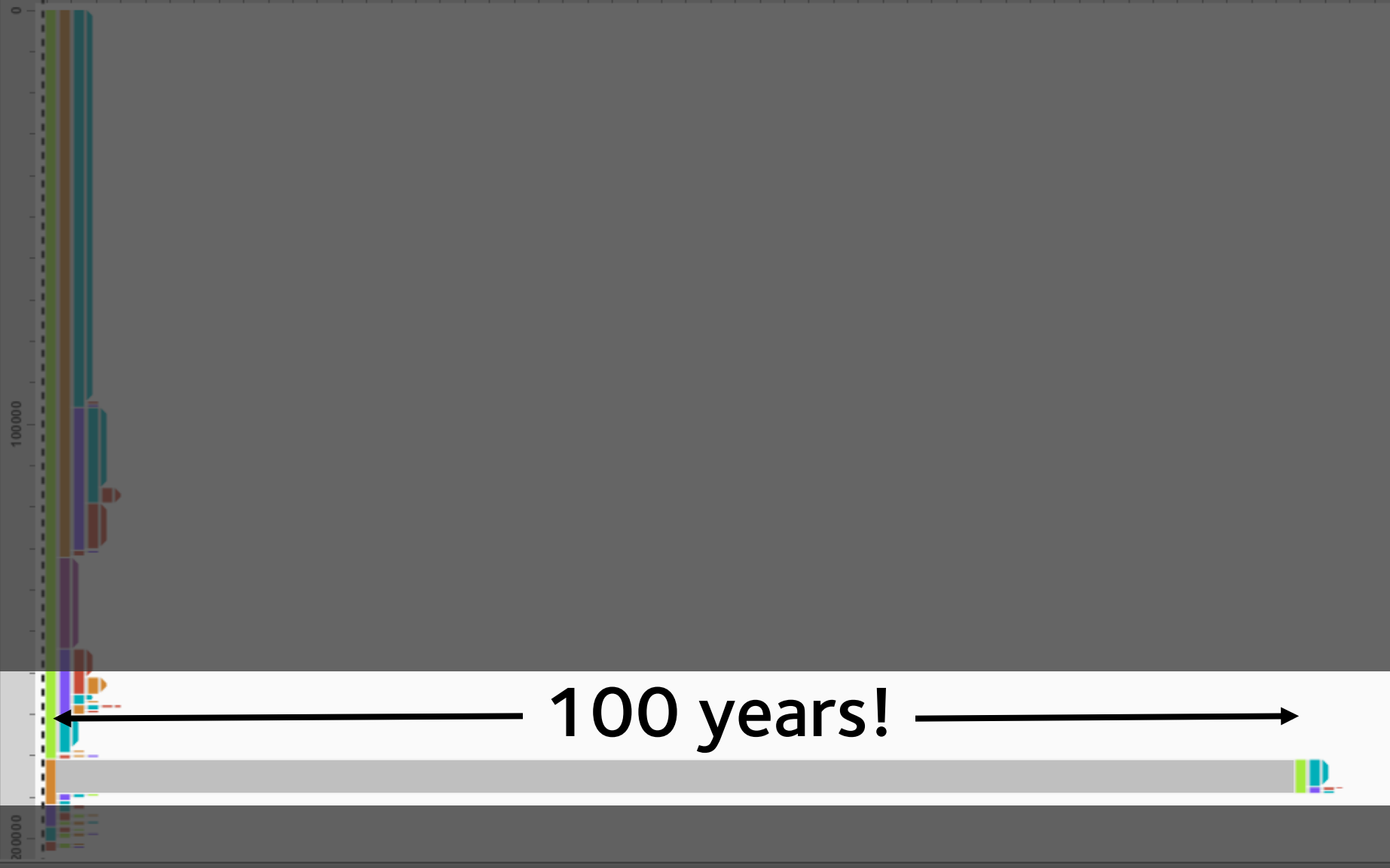


Measurement Tool

Zoom: 109 Years

Alignment

0 2Y 4Y 6Y 8Y



100 years!



Clean the data.



Data Manager Control

Raw data (CATTLab_003_al...
Showing: 195504/195504 re...

Selected: 0 record

All Remove them
None Remove others

All Overview Timeline

Align Filter

Please specify how to align:

No alignment

1 st Incident notific
from the beginning

All Incident notific

(no advanced option selected)

Advanced Options...

automatic update

Align

Legend Attribute History

- Incident notification
- Incident arrival
- Incident clearance
- Return to normal (Aggregated)
- Incident cleared
- Lane clearance
- Return to normal

Measurement Tool

Navigation arrows Zoom: 1 Hours



Raw data (CATTLab_003_al...
Showing: 195504/195504 re...

Selected: 0 record

All Remove them
None Remove others

All Overview Timeline

Align Filter

Please specify how to align:

No alignment

1 st Incident notific
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Advanced Options...

automatic update

Align

Legend Attribute History

- Incident notification
- Incident arrival
- Incident clearance
- Return to normal (Aggregated)
- Incident cleared
- Lane clearance
- Return to normal



Case Study#2: Transportation

200,000+

traffic incidents

Compare traffic agencies

Feedback

- Reveal unexpected sequences
- Identify data errors
- Can ask more questions, faster, and richer

User Study

- 10 participants
- **Goals:**
 - Learnability
 - Strategies / Problems
- **Procedure:**
 - 12-minute training
 - 15 tasks
- **Results:**
 - Participants can perform given tasks.

Quotes

“Oh! This is very cool!”

“The tool is easy to understand and easy to use.”

“Very easy to find common and uncommon sequences”

“LifeFlow provides a great summary of the big picture.”

“Can I use it with my dataset?”

Conclusions

- LifeFlow
 - Overview
 - All sequences + gap between events
- 2 case studies + 1 user study
 - Show big picture + reveal anomalies
 - New questions from the data
 - Easy to learn
- Applicable to many domains



Acknowledgement

- **Washington Hospital Center**

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<http://www.whcenter.org>

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<http://www.nih.gov>

- **CATT Lab**

Michael Pack, Michael VanDaniker, Nikola Ivanov

<http://www.cattlab.umd.edu>

Conclusions

- LifeFlow
 - Overview of event sequences
 - All sequences + gap between events
- 2 case studies + 1 user study
 - See big picture + reveal anomalies
 - New questions from the data
 - Easy to learn
- Applicable to many domains



HCIL's 28th Annual Symposium
May 25-26, 2011
University of Maryland #HCIL



Contact me
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of Event Sequences



Q&A

Any question?

LifeFlow:

Visualizing an Overview
of Event Sequences



THANK YOU
Your comments are welcome.