



西安交通大学
XI'AN JIAOTONG UNIVERSITY

VUSphere: Visual Analysis of Video Utilization in Online Distance Education

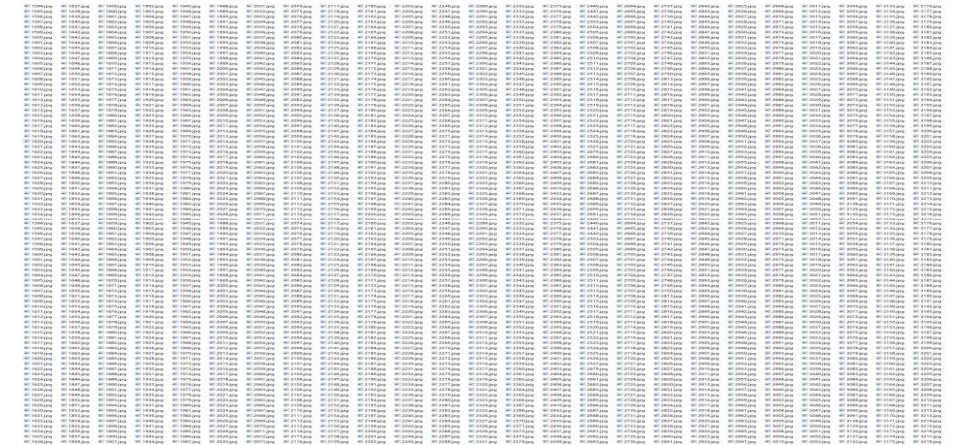
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Xi'an Jiaotong University, China

Video Utilization in ODE school

- Goal: Understand how these video resources are utilized
- Challenges:
 - Lack of comparable indicator
 - Big learning data involving videos, courses, students and learning centers in online distance education (ODE) school
 - Existing systems are not suitable for analyzing a large number of videos



400+ courses



26,000+ videos



80,000+ students
in ODE school



90+ learning centers
across whole country

Related Work

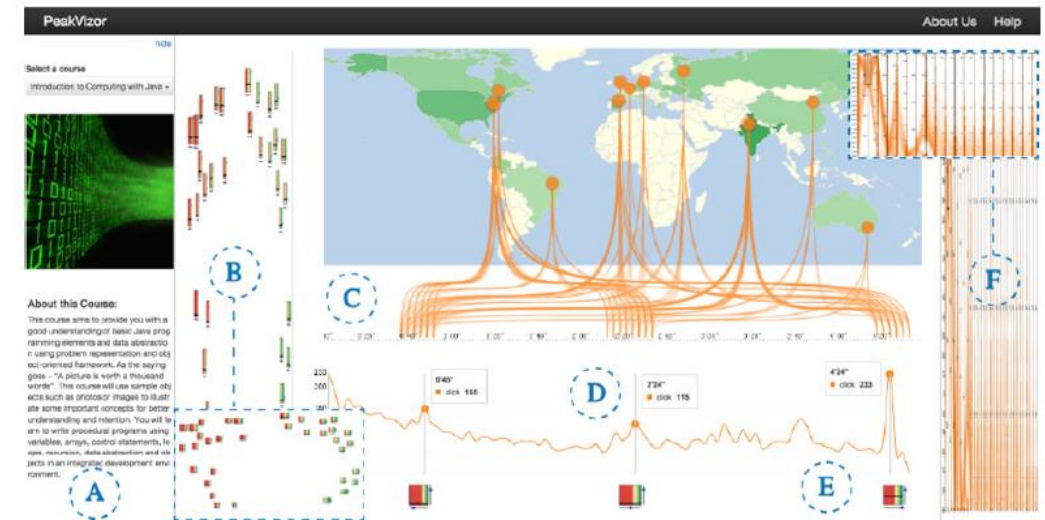
- Visual analytic systems
 - PeakVizor, VisMOOC, moocRP, Moodle, etc.
- Video analysis
 - Length, style, release strategy, demographics, learning style, motivation, etc.
- Indicators
 - Time spent on video, number of views / sessions / interactions, etc.

Advantages:

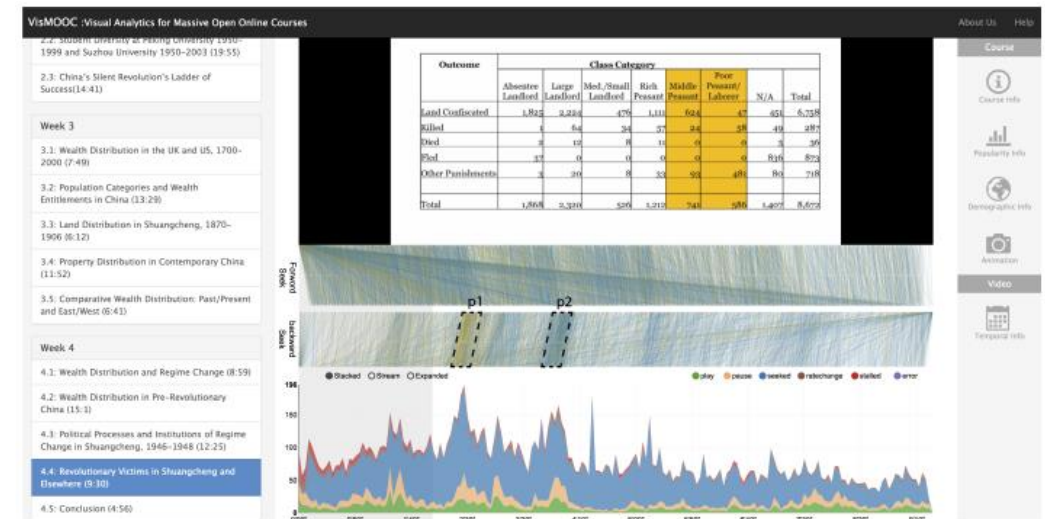
1. Fine-grained insights
2. Support visual analysis for course and video

But:

Not suitable for analyzing a large number of diverse courses and comparing different elements



PeakVizor

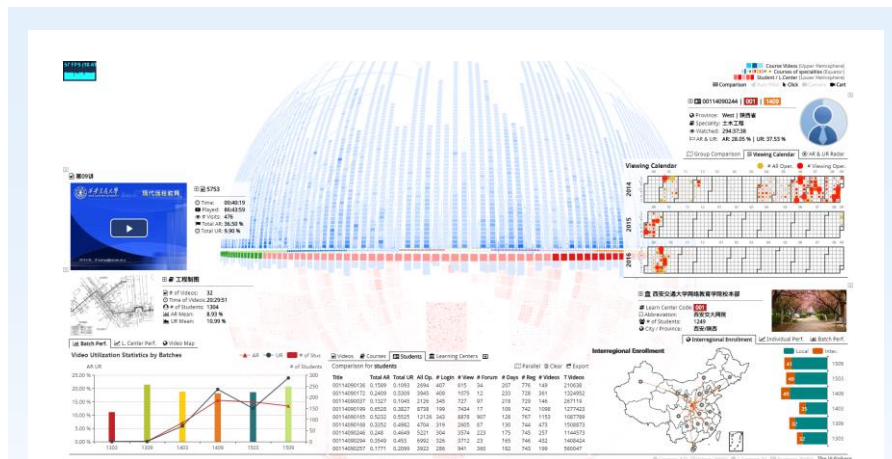


VisMOOC

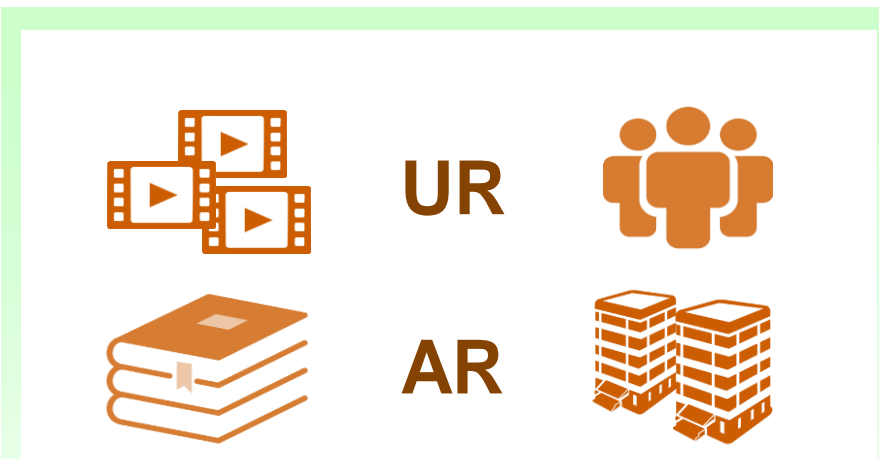


Our Work: Video Utilization Sphere (VUSphere)

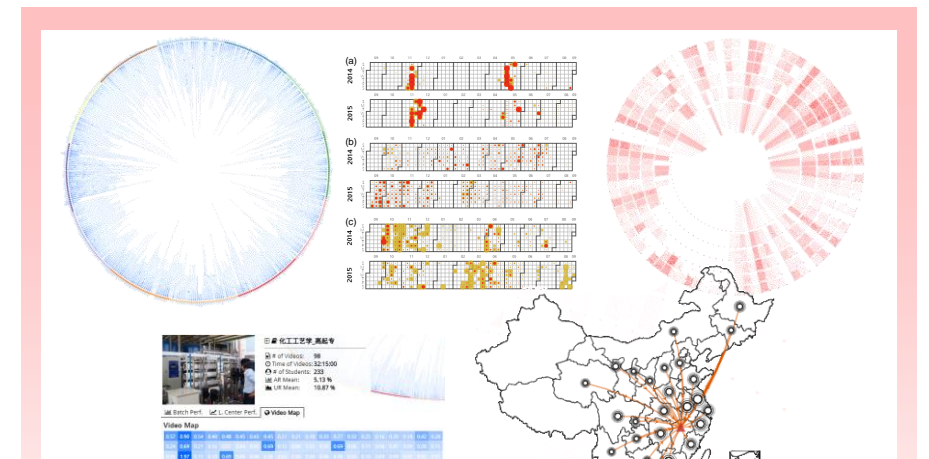
- Contributions



① An interactive visual analytics system for exploring massive videos and students



② Two indicators for measuring video utilization of students, courses, and learning centers



③ Three case studies and patterns found from real datasets

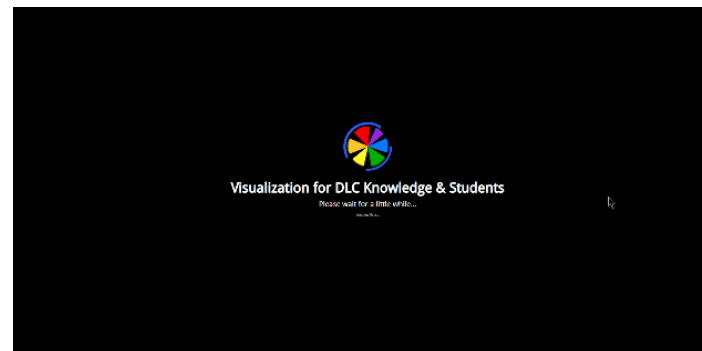
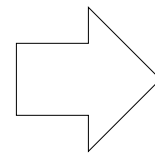
Tasks and Design Requirements

- T.1: Overall utilization of all videos
- T.2: Video utilization of each course
- T.3: Video utilization of each student
- T.4: Learning center performance
- R.1: Multi-scale exploration
- R.2: Multi-perspective presentation
- R.3: Comparative analysis
- R.4: Interactive exploration



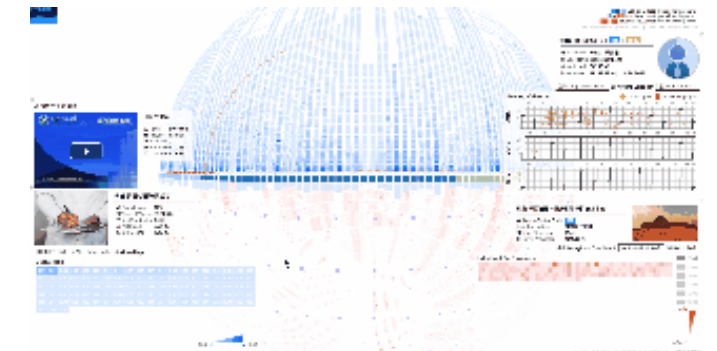
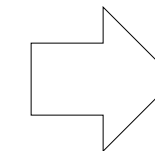
Early Prototype System in 2015

Interviews
Field studies



Early Prototype System in 2017

Improve
the design



Current System in 2018

Video Utilization Indicators

- Attendance Rate (AR)

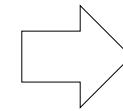
- Whether students viewed videos or not

$$ar_{s,v} = \begin{cases} 1 & \text{viewed} \\ 0 & \text{not viewed} \end{cases} \quad ar_{s,c} = \frac{|W_{s,c}|}{|V_c|}$$

- Utilization Rate (UR)

- Viewed time proportion of a video

$$ur_{s,v} = \frac{wt_{s,v}}{vt_v} \quad ur_{s,c} = \frac{\sum_{wt \in WT_{s,c}} wt}{\sum_{vt \in VT_c} vt}$$



Course AR / UR

by

- Learning center
- Region
- Batch
- Specialty

Learning Center AR / UR

by

- Batch
- Course
- Specialty

...

Student s

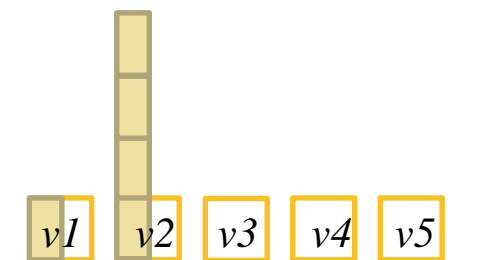
Course c , Video v 1-5

$v1$ $v2$ $v3$ $v4$ $v5$

$$ar_{s,v1} = 1$$

$$ar_{s,v2} = 1 \quad ar_{s,c} = 0.4$$

$$ar_{s,v3} = 0$$



$$ur_{s,v1} = 0.5$$

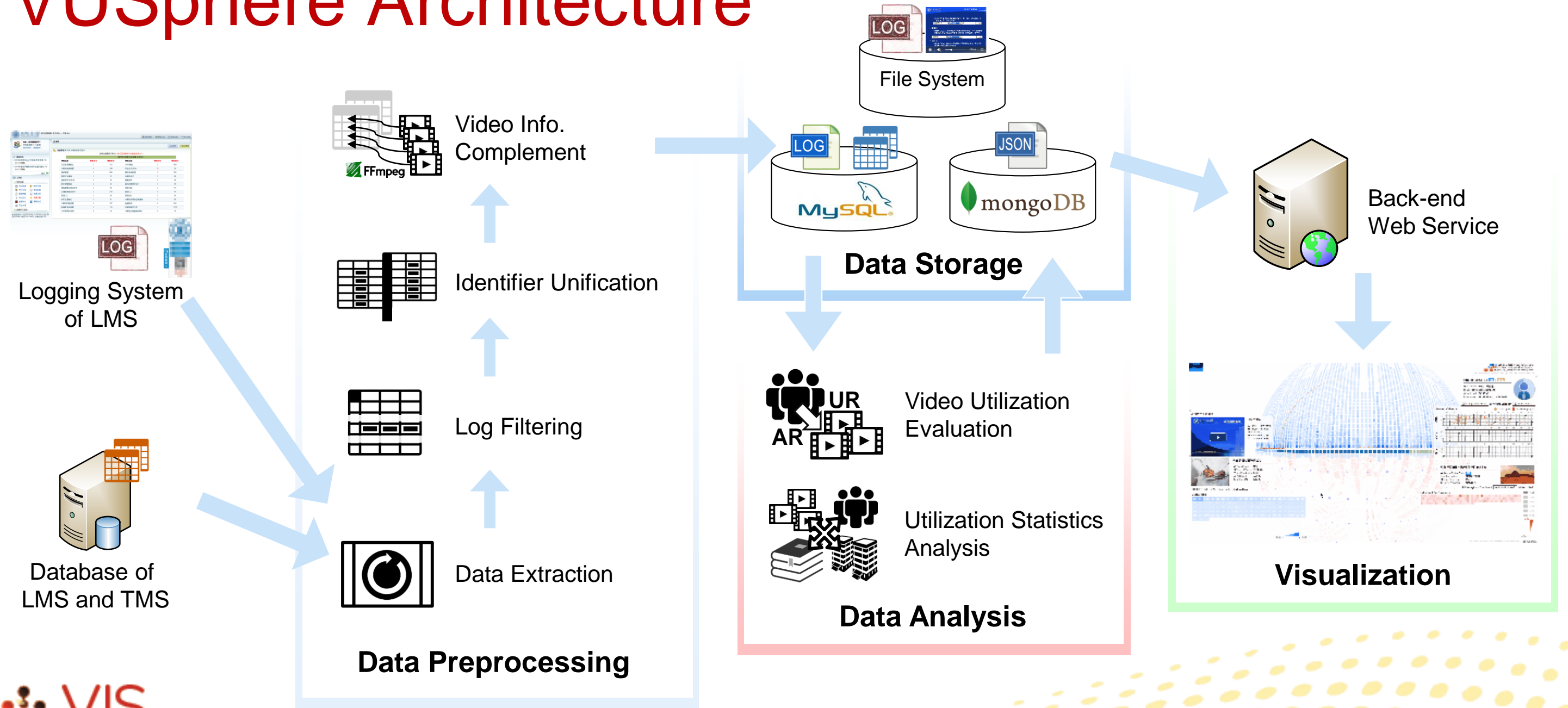
$$ur_{s,v2} = 2.0 \quad ur_{s,c} = 0.5$$

$$ur_{s,v3} = 0$$

Advantages: 1. Comparable between different courses, specialties, learning centers

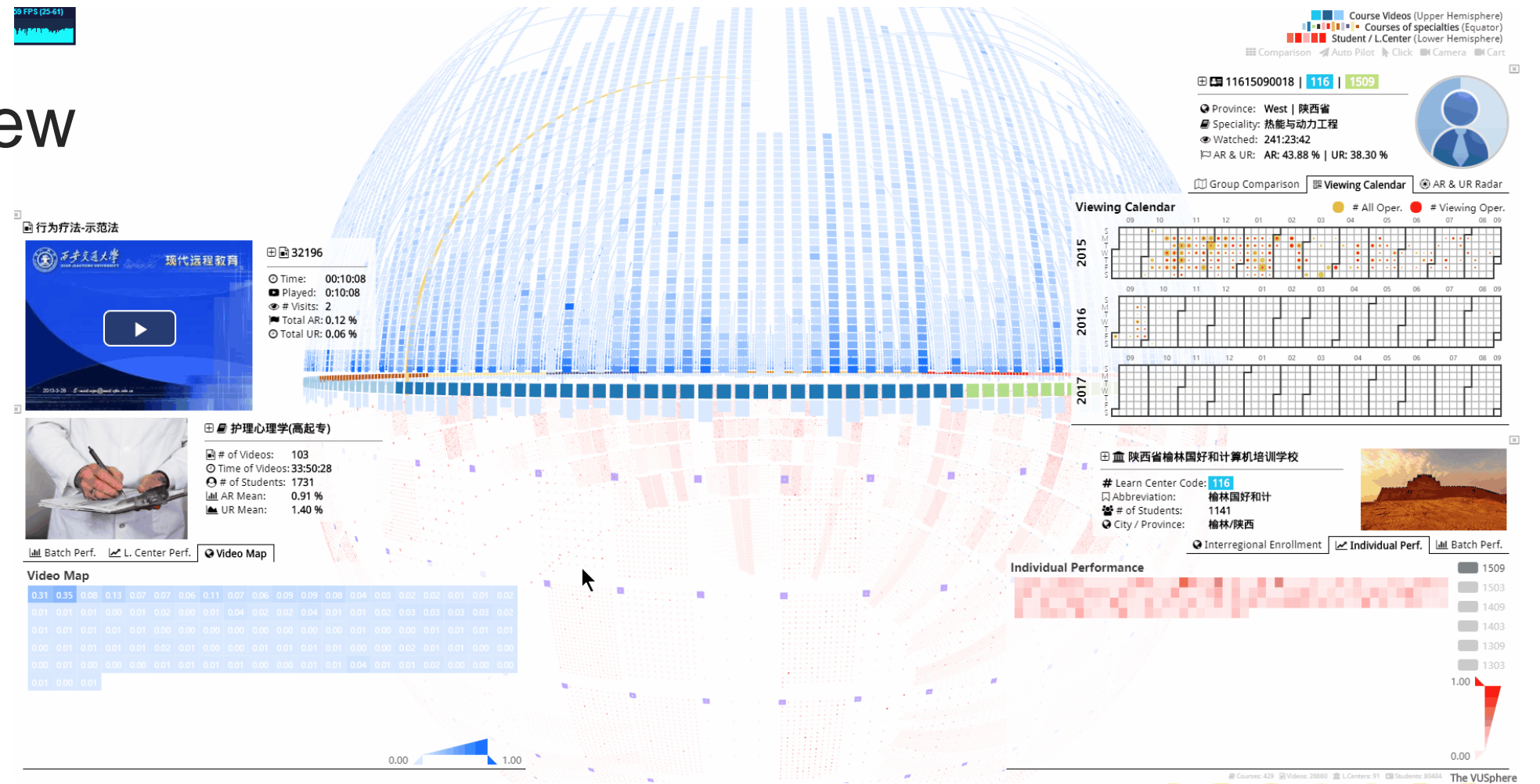
2. Easy to explain to users and teachers

VUSphere Architecture



VUSphere Design

- Overview
- Detailed Statistics View
- Comparison View



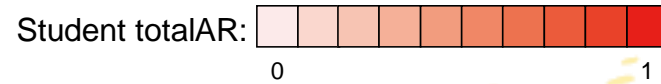
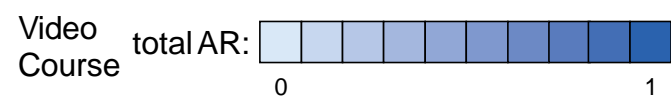
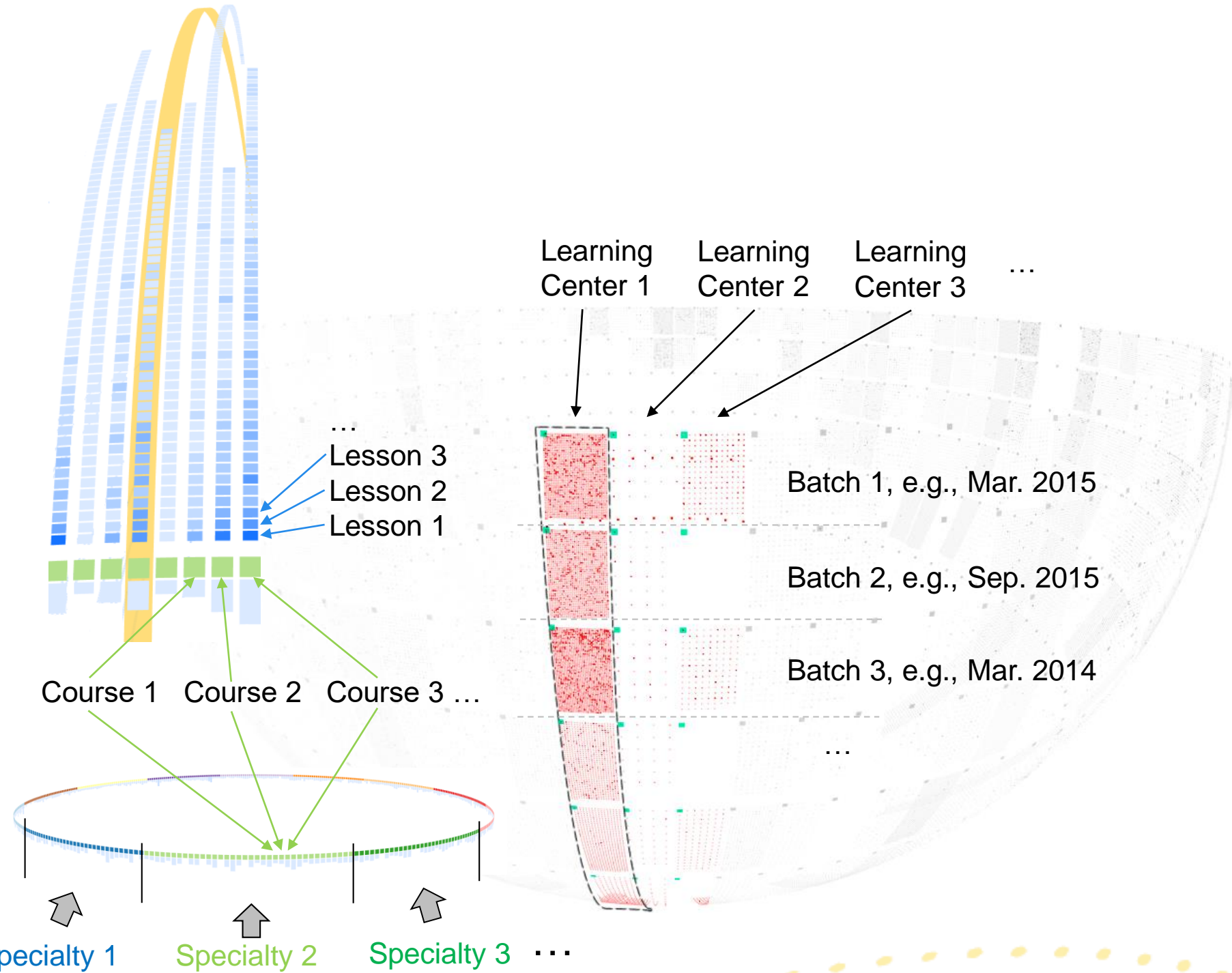
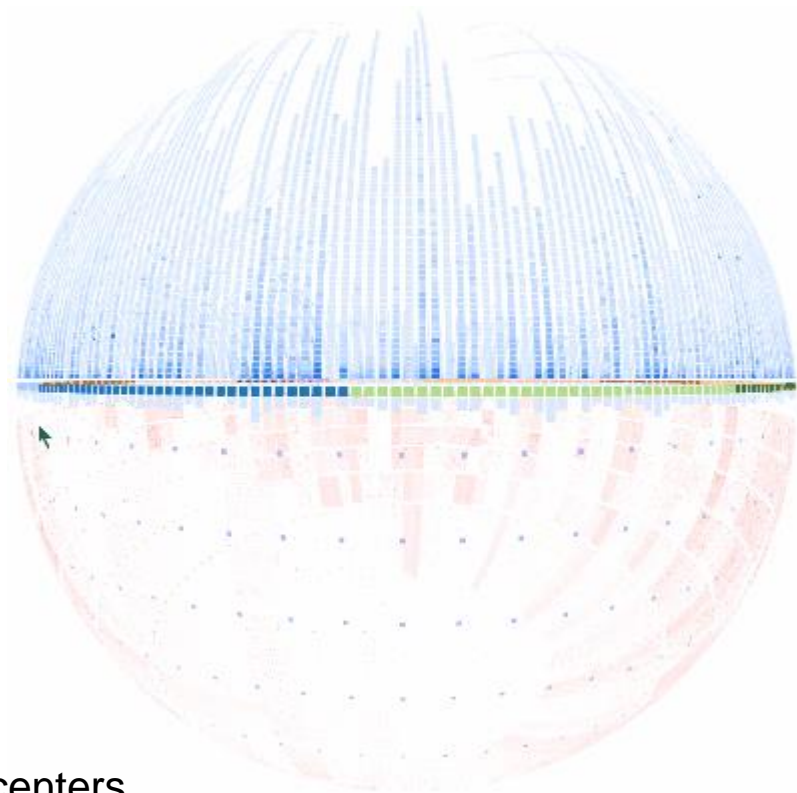
Design 1

- Spectral Layout Overview

Upper Hemisphere
videos

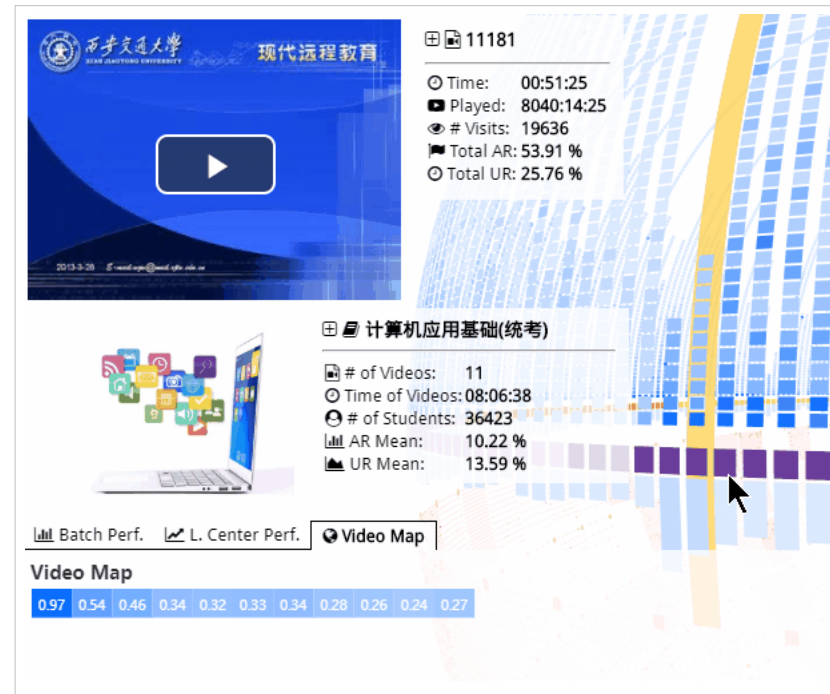
Equator
courses

students
learning centers
Lower Hemisphere

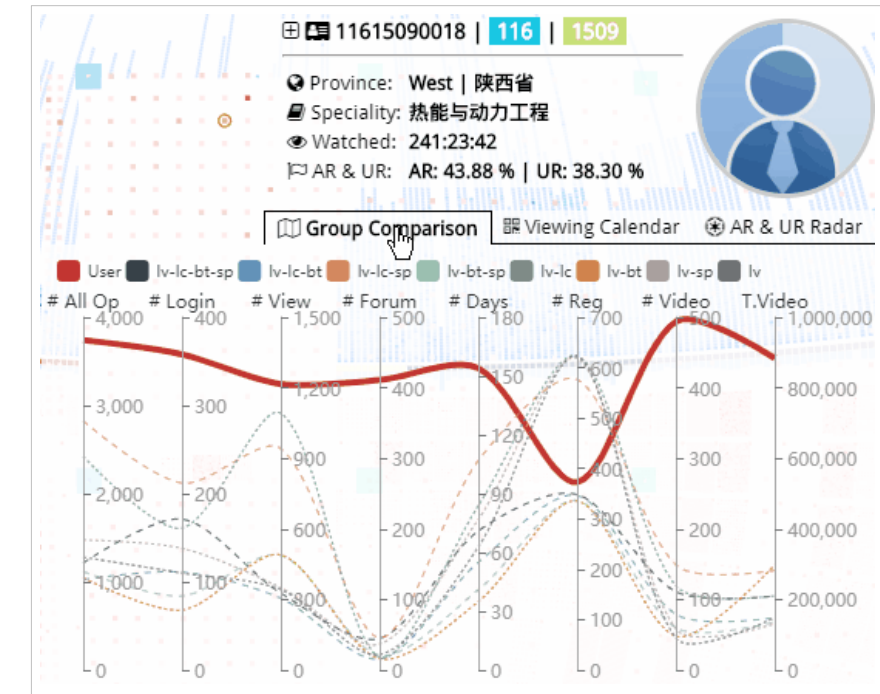


Design 2

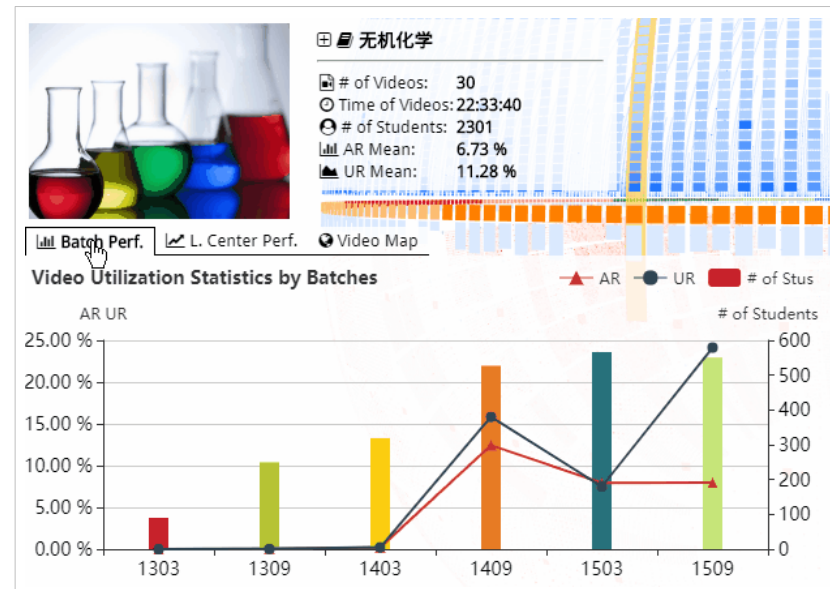
- Detailed Statistics View
 - Video
 - Course
 - Student
 - Learning Center
- Comparison View



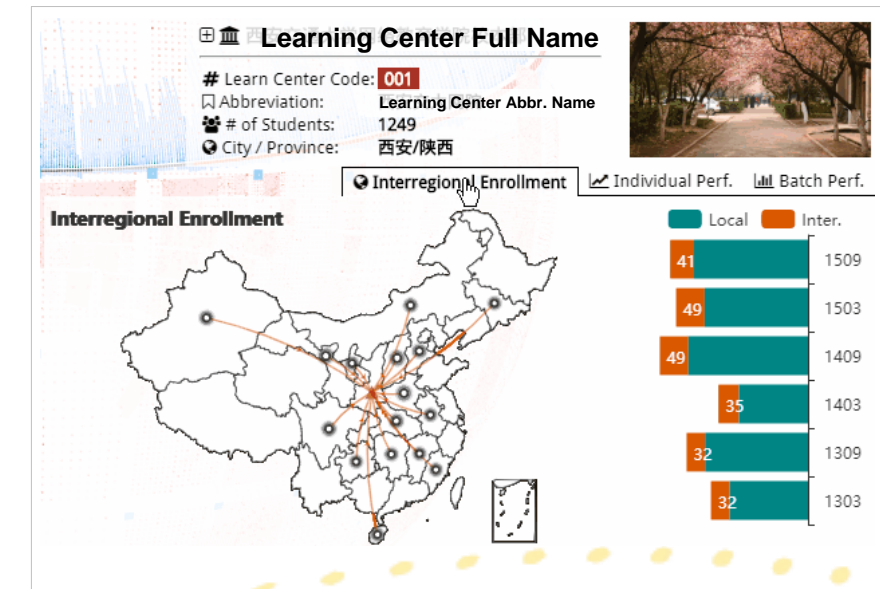
Video Panel



Student Panel



Course Panel



Learning Center Panel

Comparison for videos

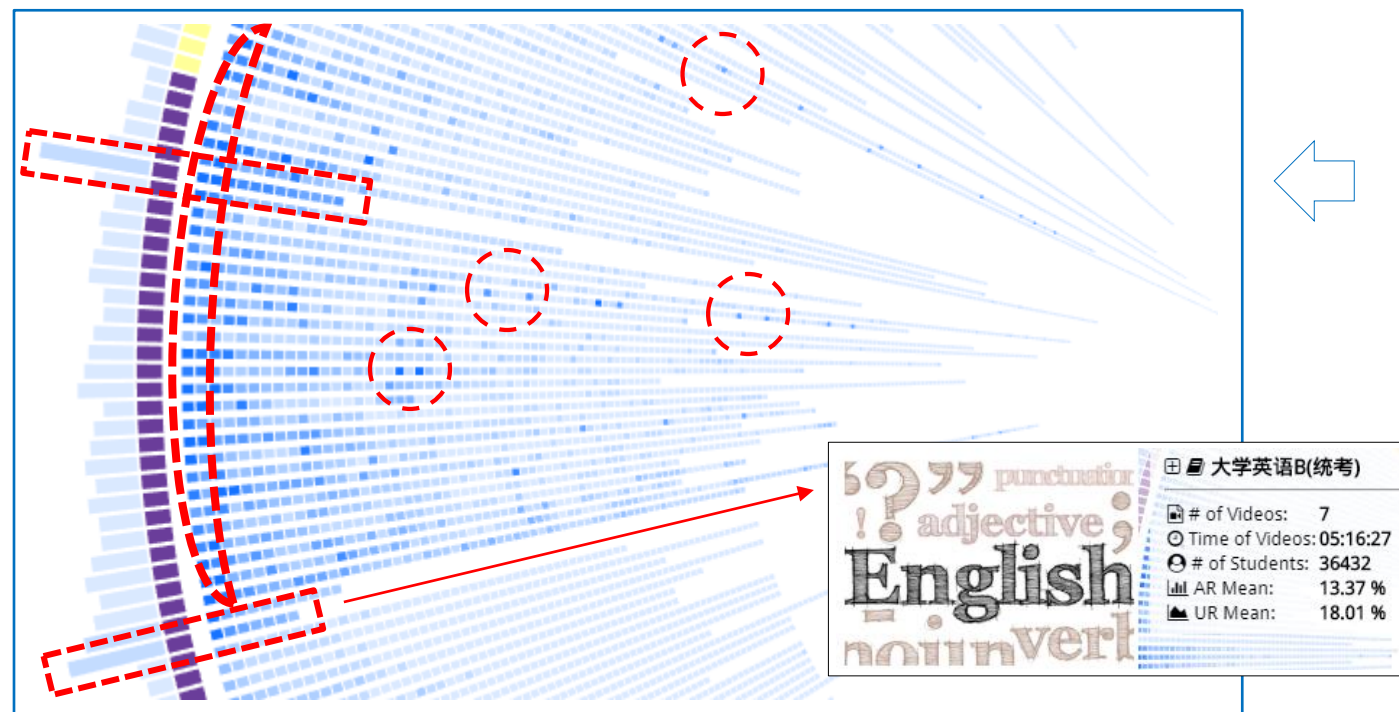
Title	Length	Total AR	Total UR	# Visits	Played
健康评估的概念与重要性	1200	0.8402	0.3233	6811	3144801
健康评估的课程内容、学习方法及要求	900	0.4113	0.1737	3334	1267013
全身状态	1560	0.1917	0.0537	1554	678770
皮肤	1200	0.2486	0.0302	2015	294119
水肿	1200	0.2381	0.0866	1930	842652
脱水	900	0.1989	0.0491	1612	358113
呼吸困难	1200	0.2098	0.0584	1701	567793
咳嗽与咳痰	900	0.1665	0.0563	1350	410809

Comparison Panel

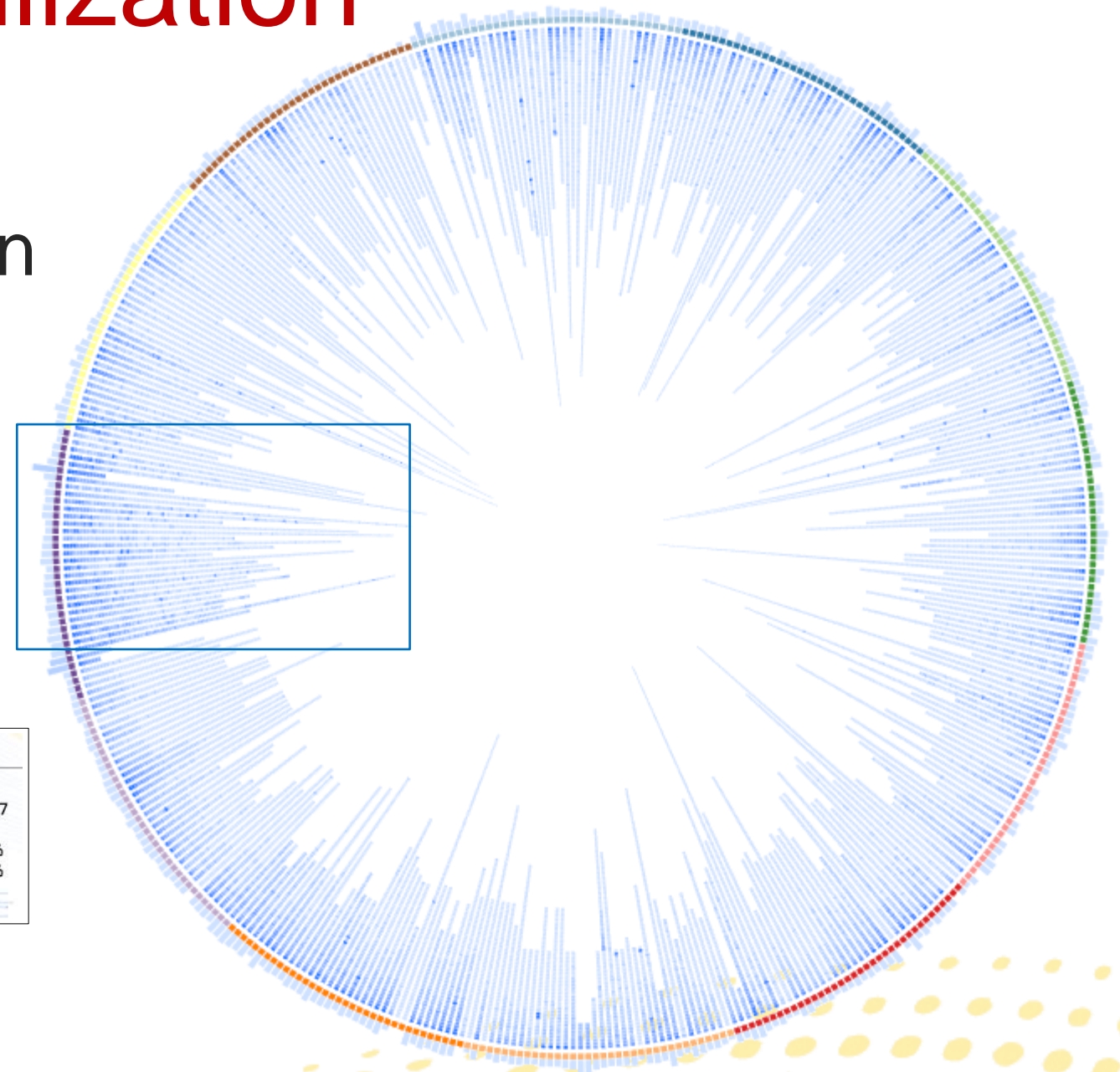


Case 1: Overall Video Utilization

- “Lesson 1,2,3” and short-term training course has higher utilization

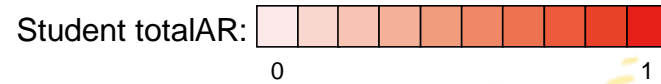
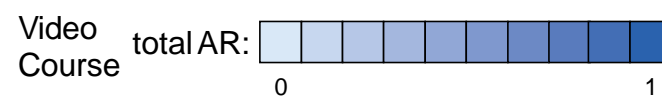
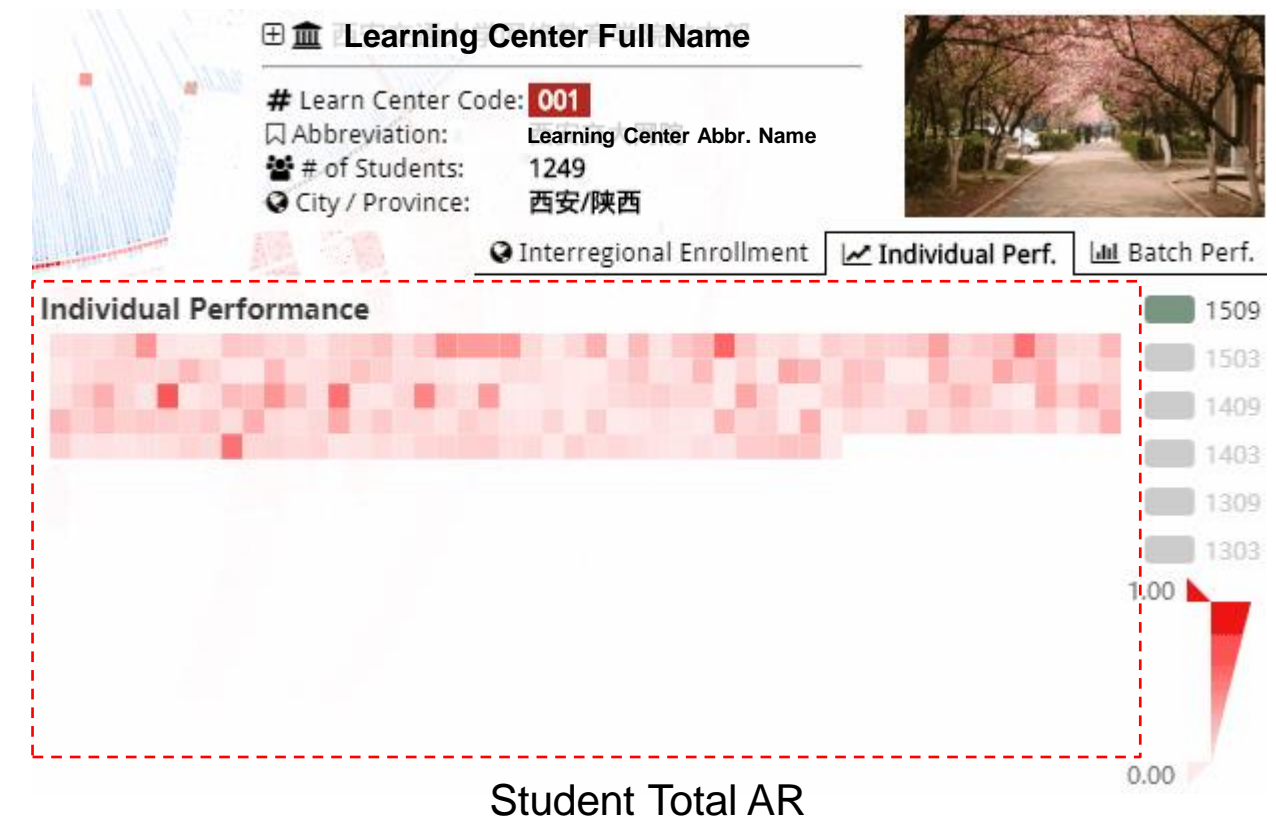
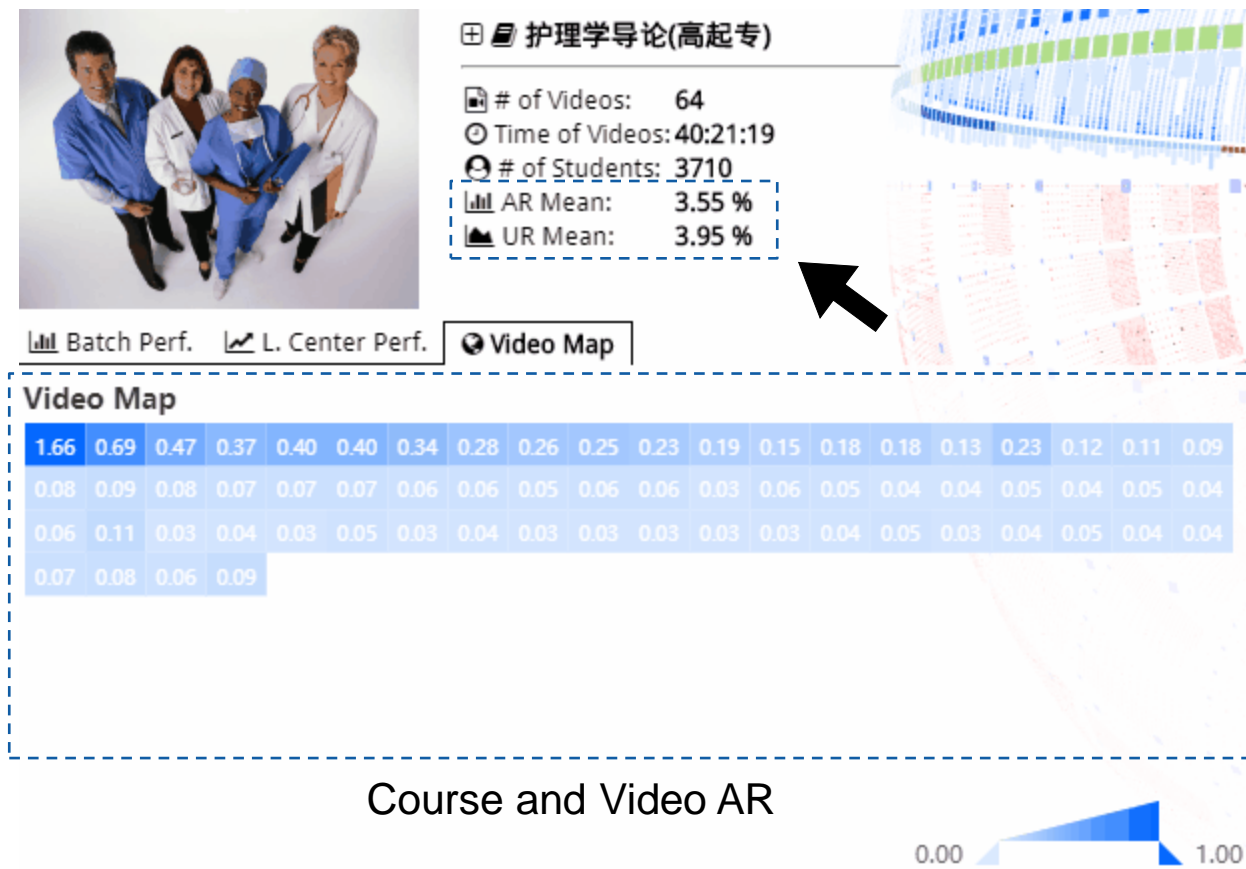


The magnified area of the blue box



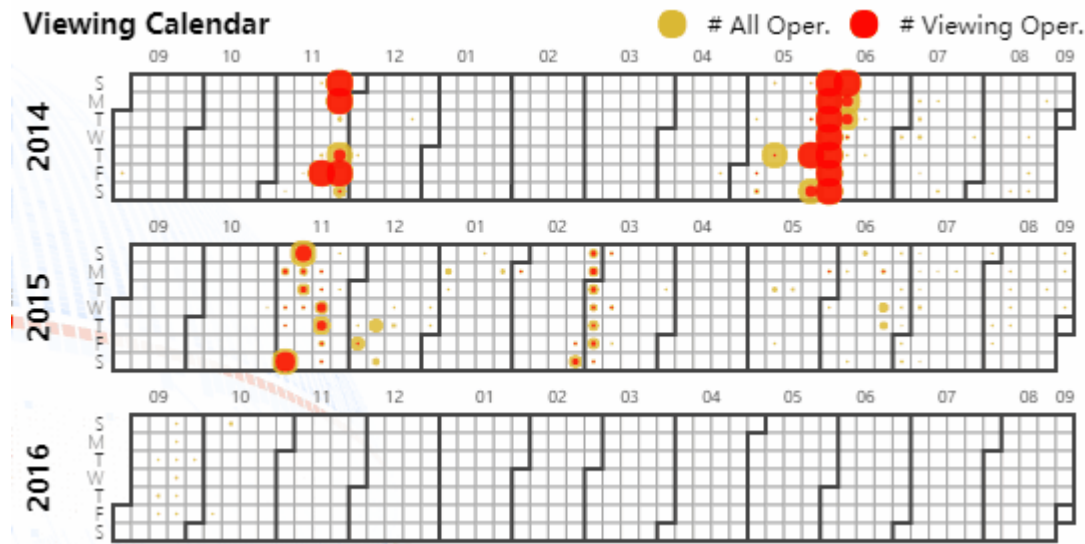
Case 1: Overall Video Utilization

- Most courses and students have low AR and UR

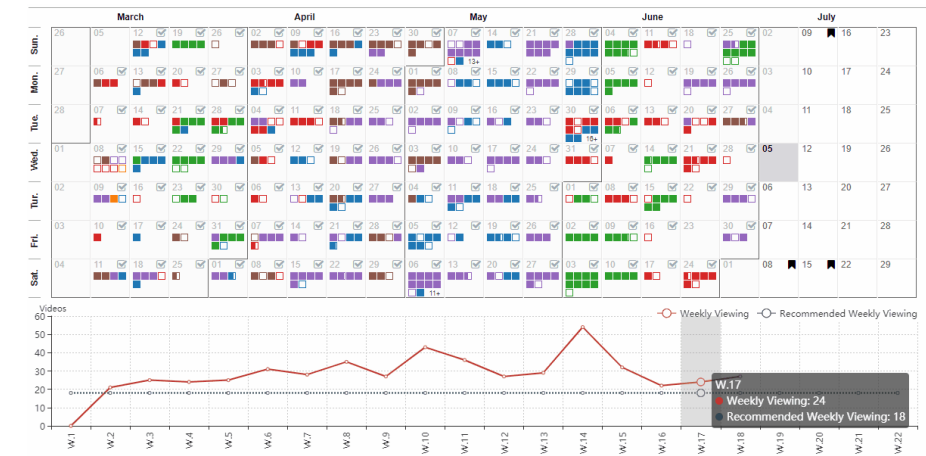
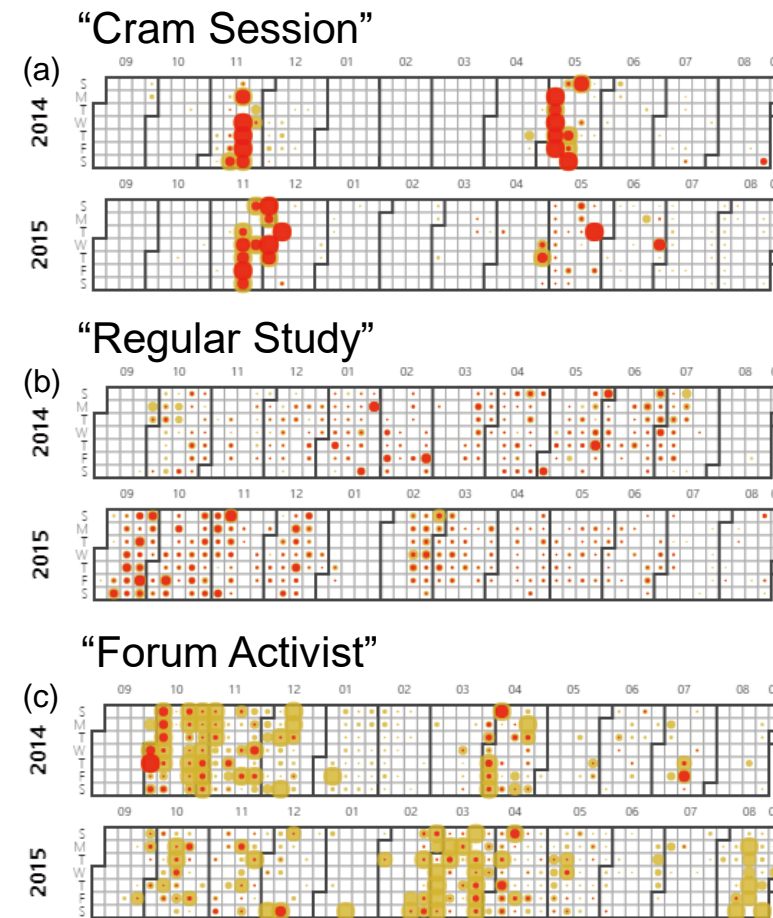


Case 2: Video Utilization Patterns

- Viewing Patterns



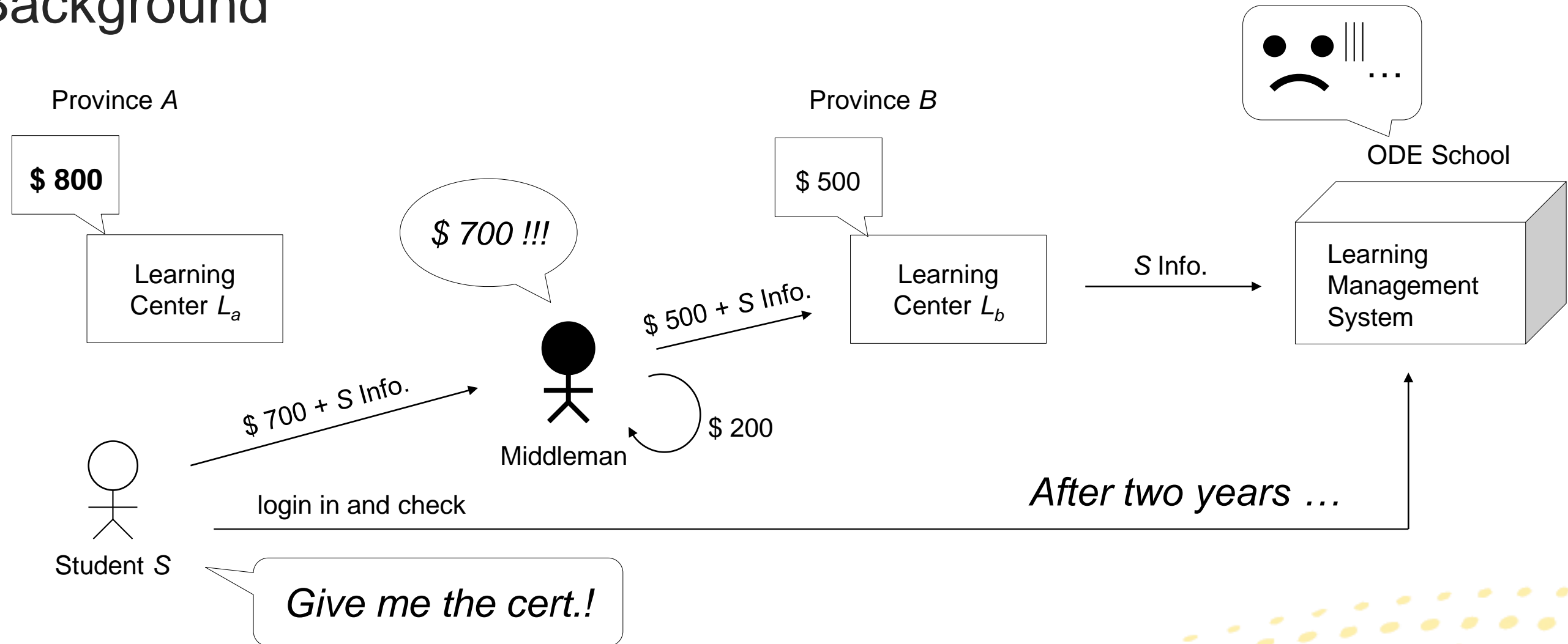
Viewing histories



New features for students based on this tab
Detailed Video Viewing in Each Day

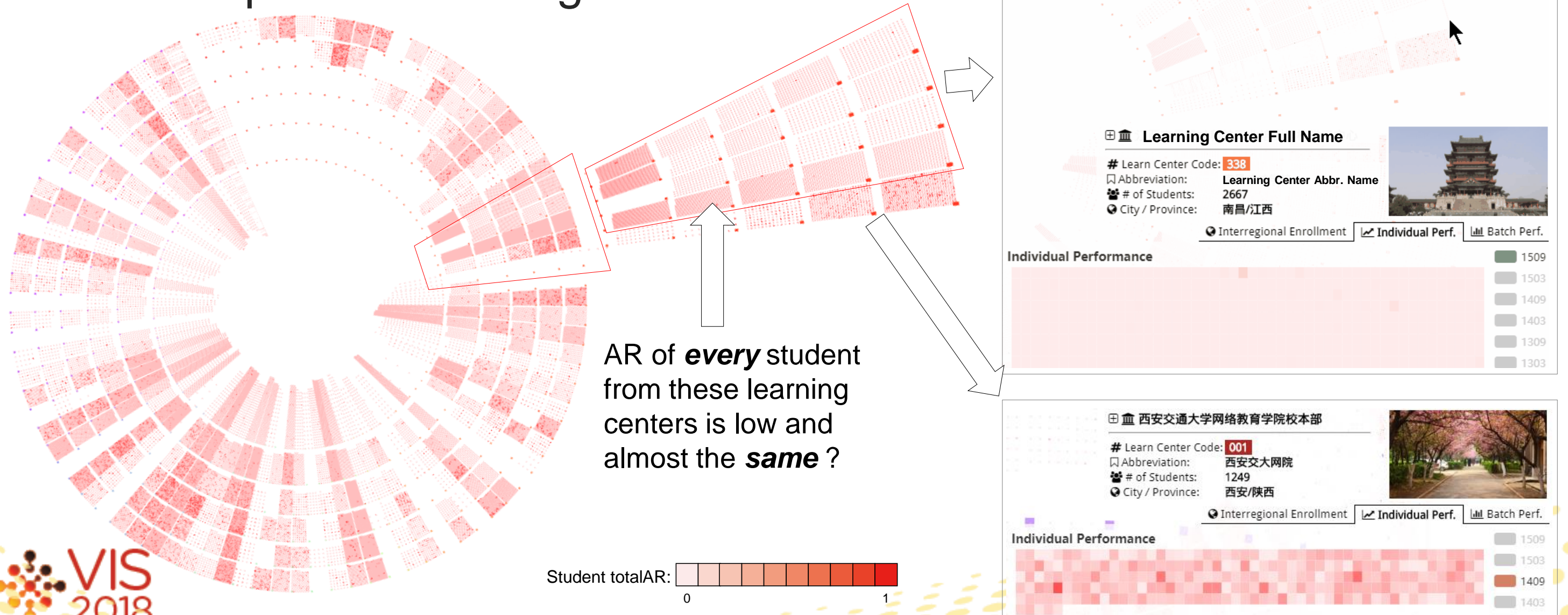
Case 3: Abnormal Learning Center

- Background



Case 3: Abnormal Learning Center

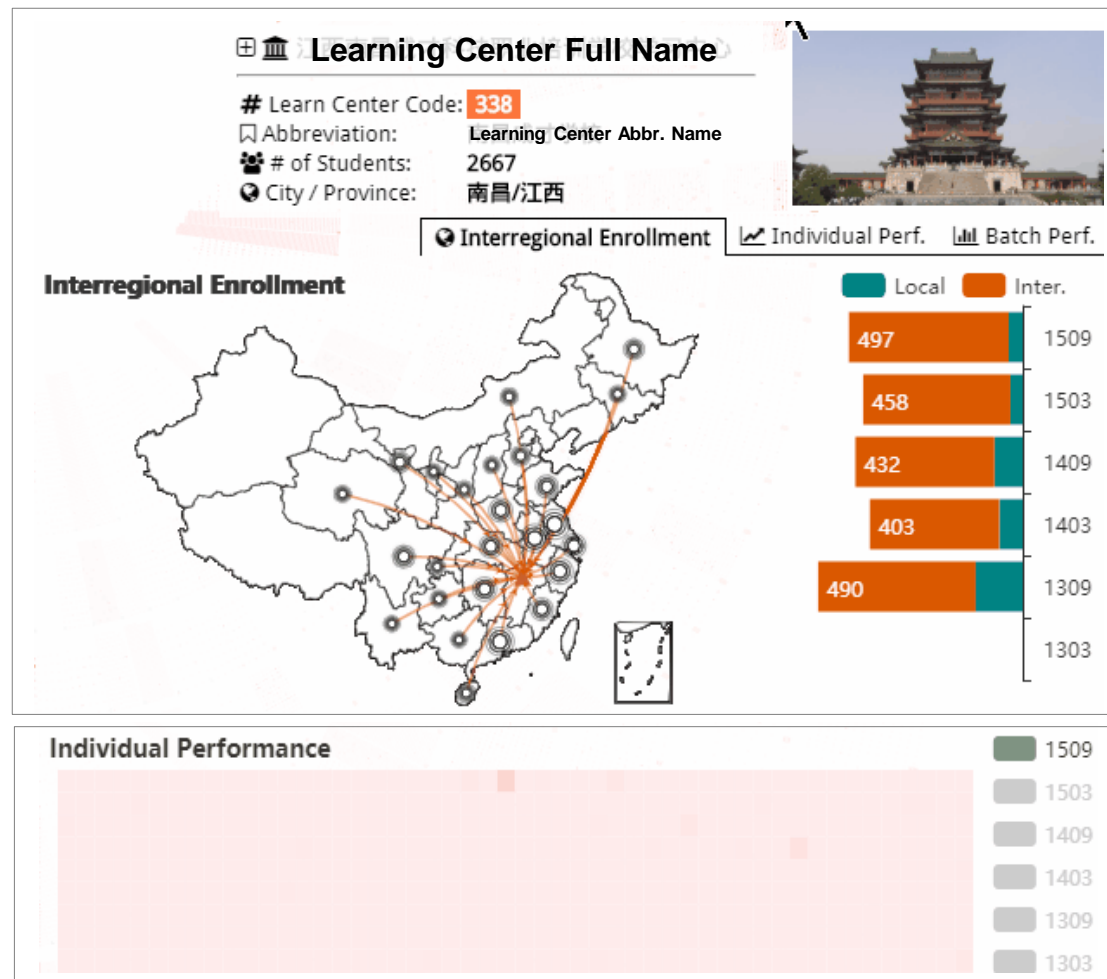
- Find suspicious learning centers



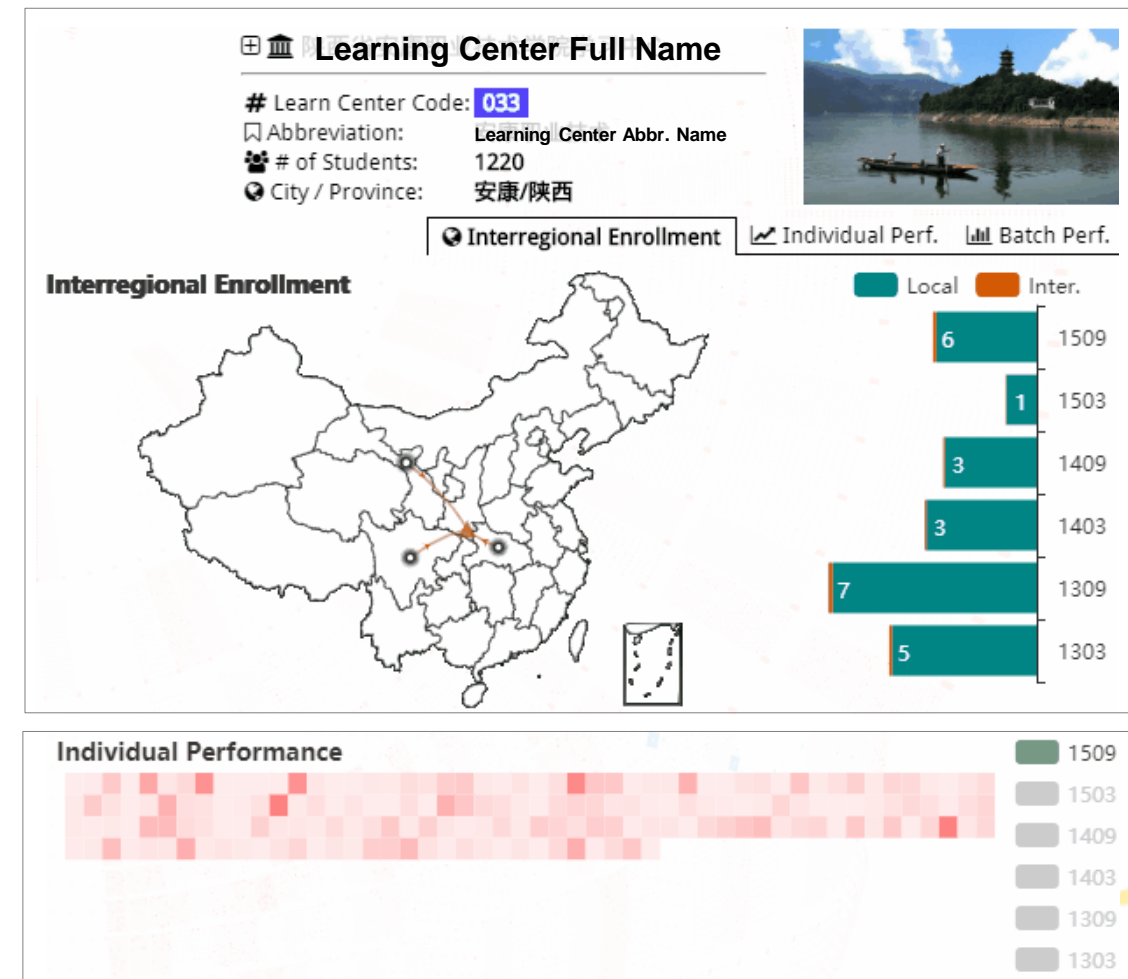
Case 3: Abnormal Learning Center

- Combination with Interregional Enrollment

Abnormal Learning Centers



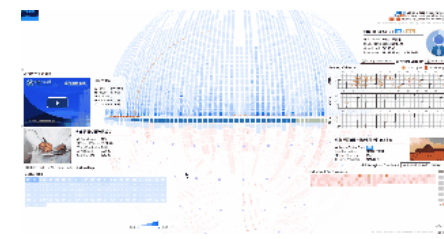
Normal Learning Centers



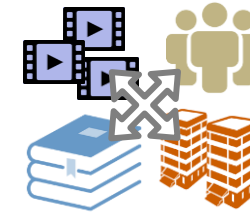
Summary

- Contributions

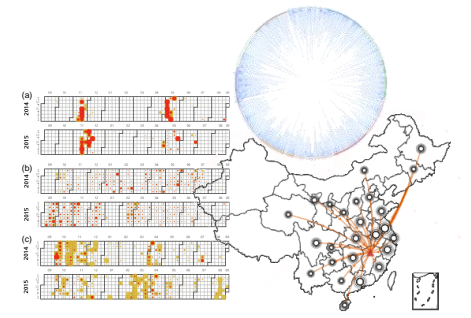
- 1. An interactive visual analytics system
- 2. Two comparable indicators
- 3. Three case studies and several patterns



VUSphere



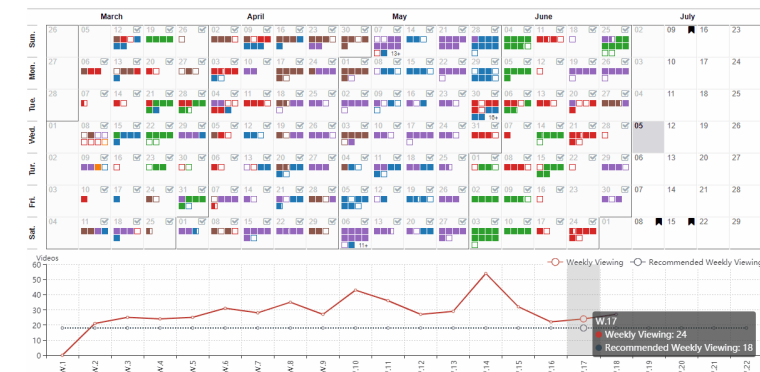
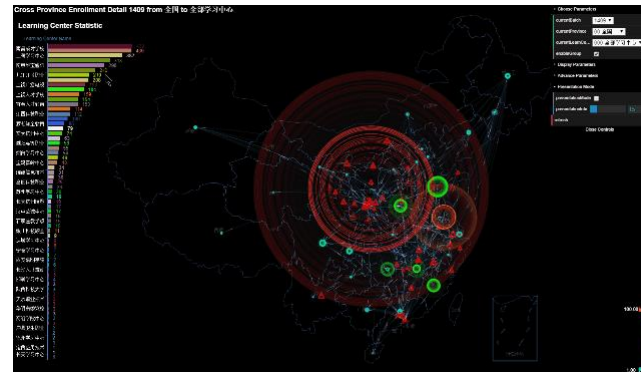
UR / AR



Case studies

- Future work

- Standalone applications
- Patterns analysis
- Evaluation



Thank you!