What's most broken?
Statistical Probe of Tutoring for data-driven improvement of Intelligent Tutors

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MOTIVATION

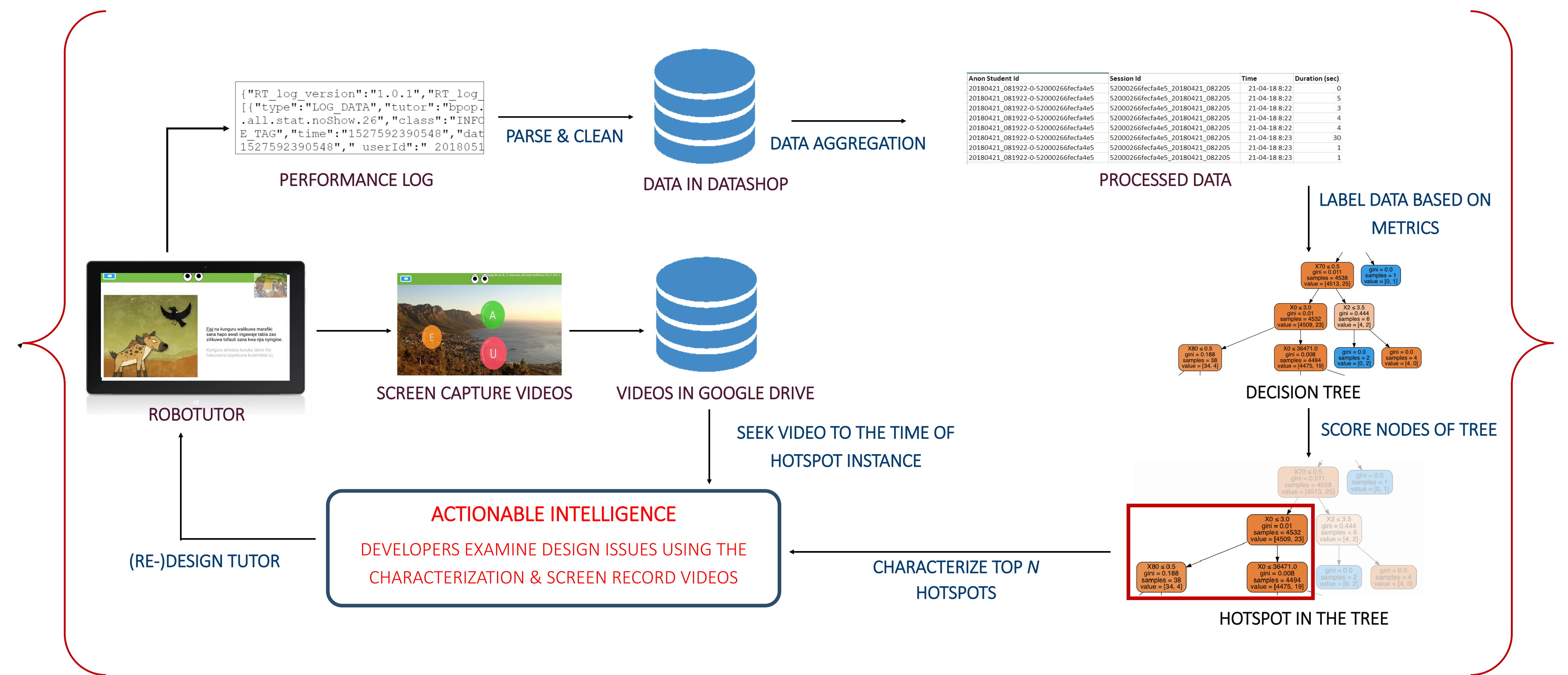Questions that we look to answer from RoboTutor's log data [1]:

- **Reliability:** How often and under what conditions does the RoboTutor crash or hang?
- **Recognition:** How often is written input accepted by the Writing Recognizer?
- **Usability:** Can kids operate RoboTutor? Which activities do children find hard to navigate through? Where does the time go?
- **Engagement:** When are the children disengaged? What activities disengage students most?

Is there a way to automate discovery of the critical design issues therein, and characterize, prioritize and present them?
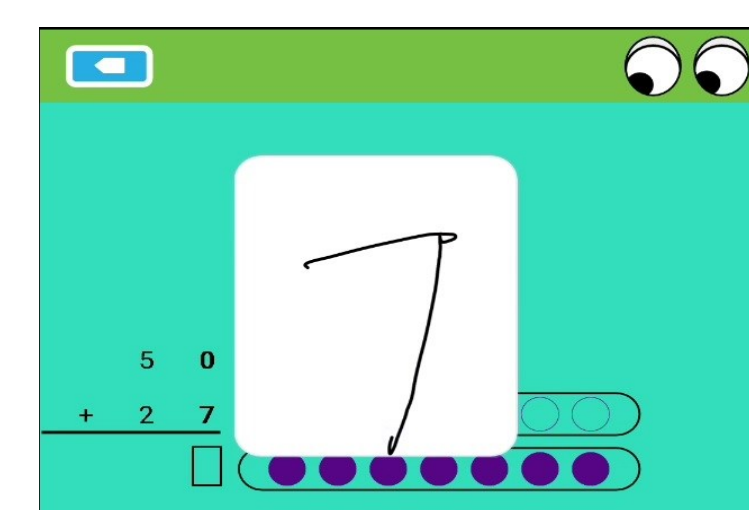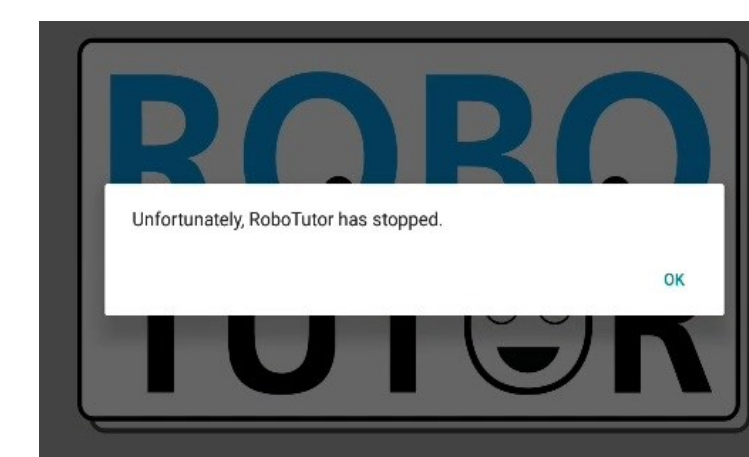

SPOT Workflow

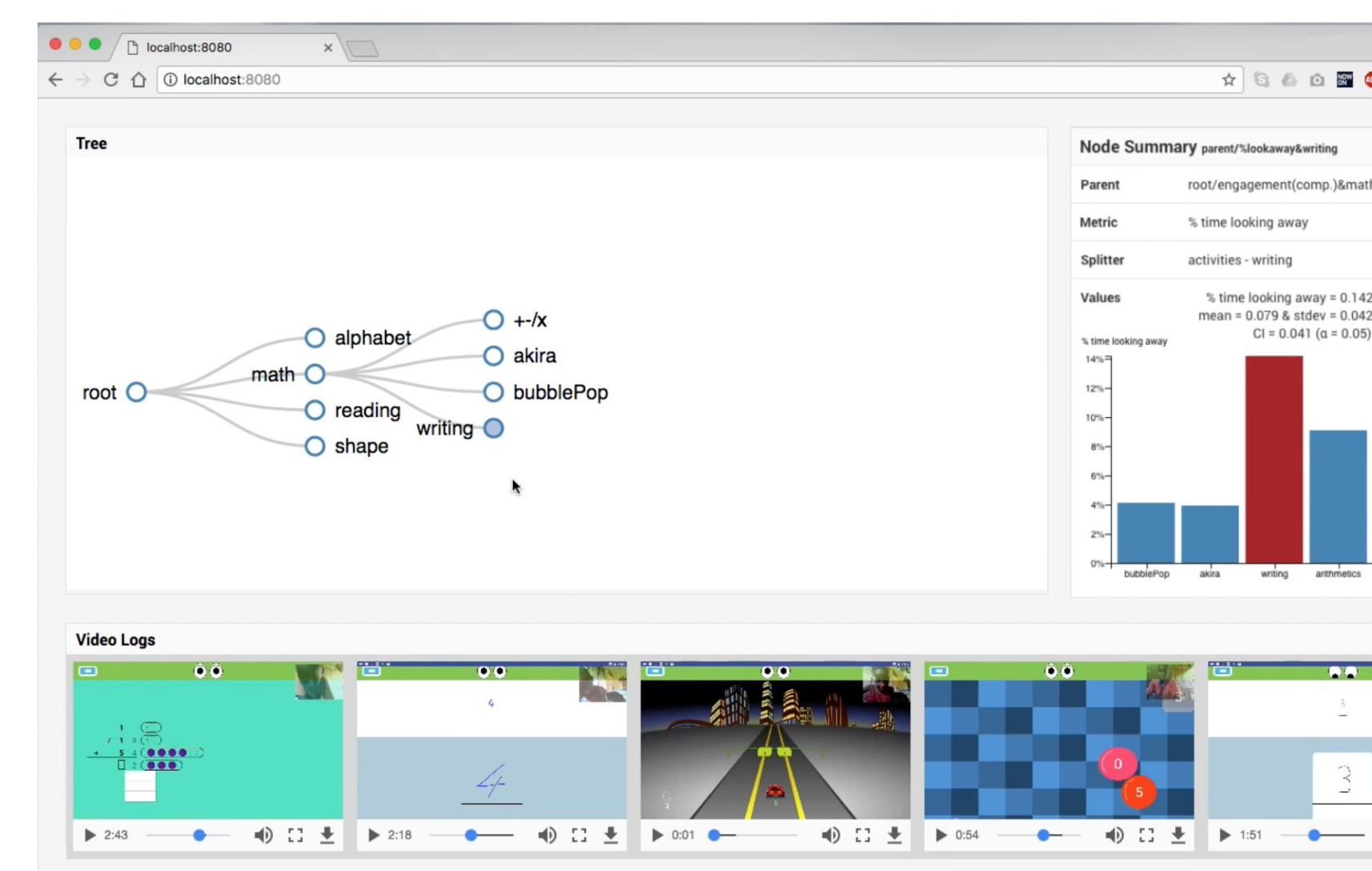DESIGN ➔ PROTOTYPE ➔ DEPLOY ➔ COLLECT DATA ➔ MINE DATA FOR INSIGHTS ➔ REDESIGN...

PERFORMANCE LOG — PARSE & CLEAN — DATA IN DATASHOP — DATA AGGREGATION — PROCESSED DATA — LABEL DATA BASED ON METRICS

ROBOTUTOR — SCREEN CAPTURE VIDEOS — VIDEOS IN GOOGLE DRIVE — DECISION TREE — SCORE NODES OF TREE

SEEK VIDEO TO THE TIME OF HOTSPOT INSTANCE

ACTIONABLE INTELLIGENCE
DEVELOPERS EXAMINE DESIGN ISSUES USING THE CHARACTERIZATION & SCREEN RECORD VIDEOS

CHARACTERIZE TOP *N* HOTSPOTS

HOTSPOT IN THE TREE

(RE-)DESIGN TUTOR

RESULTS

CRITERIA & METRICS	SPOT FINDINGS	DESIGN IMPLICATIONS
Reliability Session changes for the same student on a tablet within a short time	Crashes especially occur in CountingX and Story Reading activities	Implement crash logging Examine CountingX and Story Reading activities for bugs
Recognition Rejection rate of written and spoken input	Recognizer confuses between number pairs like 1 & 7, 5 & 3	Bias data sources of number copying and dictation to include frequently confused digits
Usability Attempt and activity hiatus (time between end of one attempt / activity and start of next)	Children spend unusually long time in Story Reading activities	Add a timeout for story reading
Engagement Bailouts Average duration per attempt and item	Children tend to bail out of an activity when given the same problems to solve repeatedly	Children should not be given similar problems repeatedly

FUTURE WORK

- Develop SPOT as a web application [2]
- Integrate SPOT into LearnSphere [3], a community infrastructure to support learning improvement online
- Analyze learning, especially wheel-spinning using SPOT: Identifying skills that children are unable to learn given 'enough' practice opportunities?

REFERENCES

[1] Judith (Odili) Uchidiuno. (2018). 'data as of 2018-07-12 at 16:00 (V02)' , Uploaded to DataShop (Koedinger et al., 2010)

[2] Henry, Gus, Lin, Jessica, Park, Cheul, *REFINING ROBOTUTOR - BHCI CAPSTONE S'17*, 2017

[3] http://learnsphere.org/

ACKNOWLEDGEMENTS