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Interpretation of semi-structured hand-drawn sketches for the conception of a Pen-Based Intelligent Tutorial System

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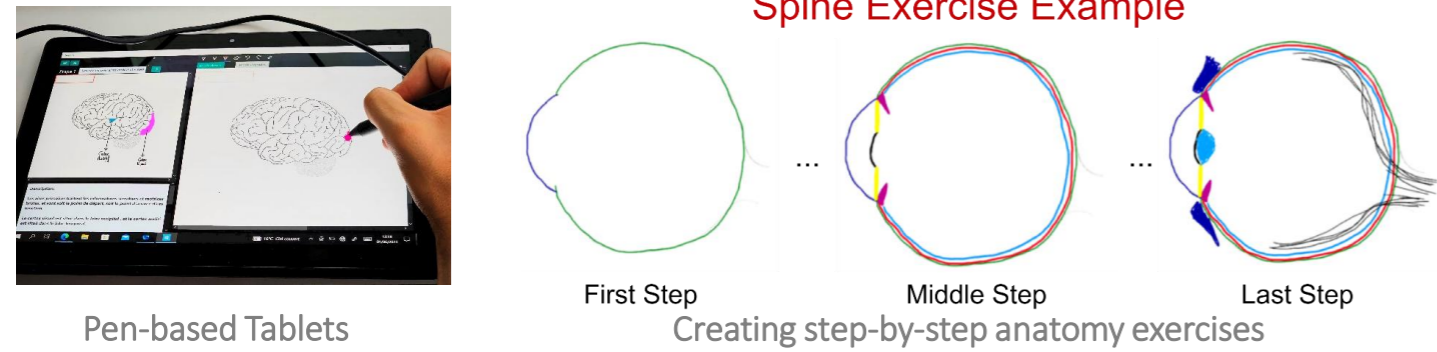
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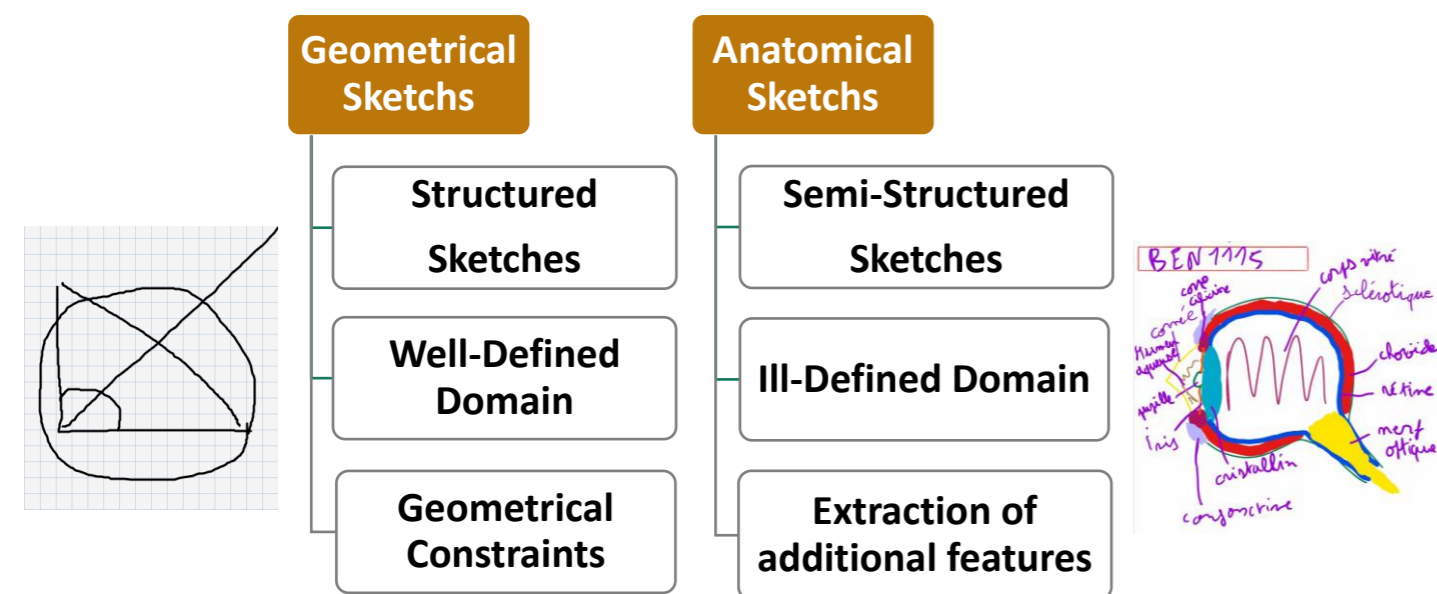
1. Context & Challenges

- ✓ **Learning by drawing** can improve the learning experiences for students [Fiorella+2015].
- ✓ **Real-time feedback** improves the students' ability to learn [Kulik+1998].
- ✓ Simulation of the pen-and-paper approach is possible on **pen-based tablets**.

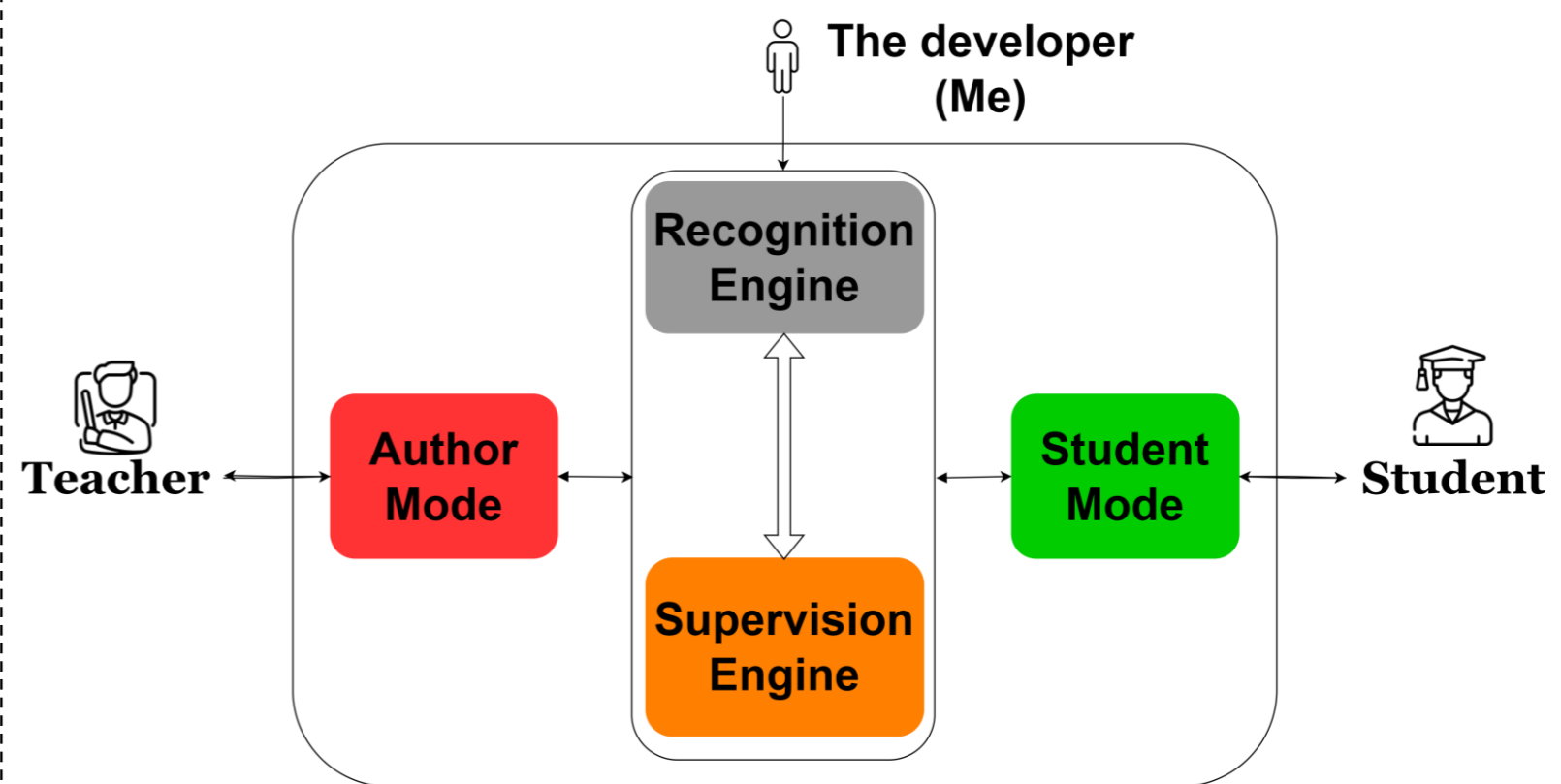


ITS for the field of Anatomy

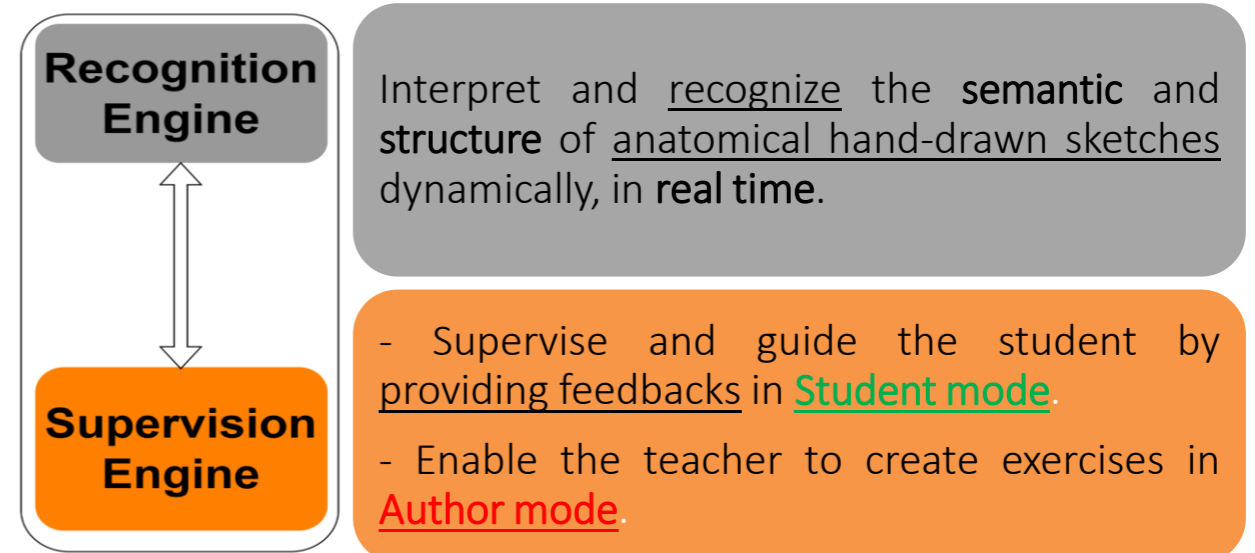
- ➔ Need to **recognize** hand-drawn anatomical sketches
- ➔ Need to **generate adaptive feedbacks** to students



2. Objectives & Fundamentals

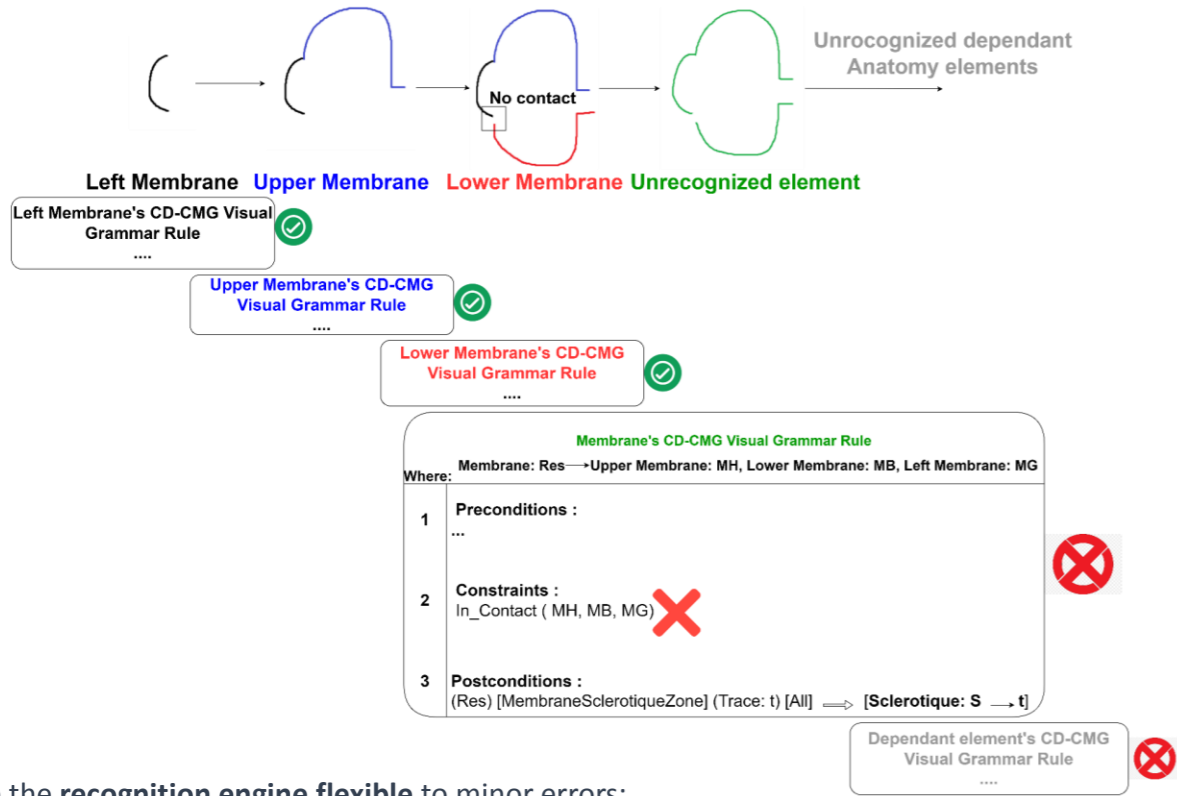


IntuiSketch : Intelligent Tutorial System



3. IntuiSketch's Flexible Recognition Engine

- Students make **major and minor errors**.
- Minor errors **shouldn't interrupt progress**.



✓ Make the recognition engine flexible to minor errors:

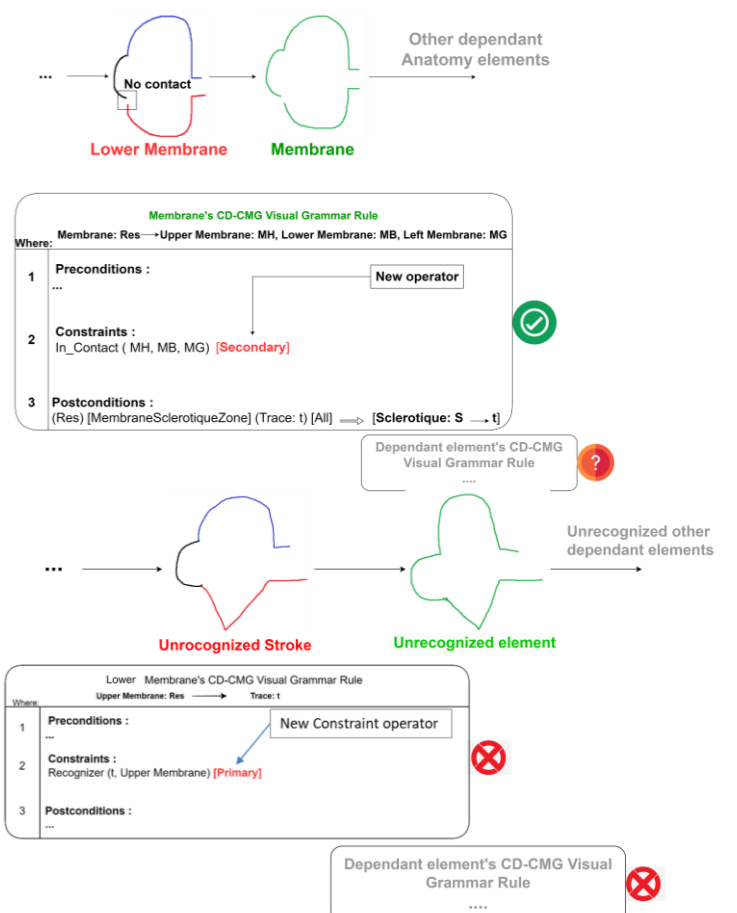
➔ **Categorisation into Primary Constraints and Secondary Constraints.**

Primary Constraints (PC):

- ✓ **Recognition:** Essential for basic recognition
- ✓ **Feedback:** Immediate feedbacks
- ✓ **Learning Impact:** Foundational understanding
- ✓ **Examples:** Shape, positioning, basic geometric constraints
- ✓ **Tolerance:** Low

Secondary Constraints (SC):

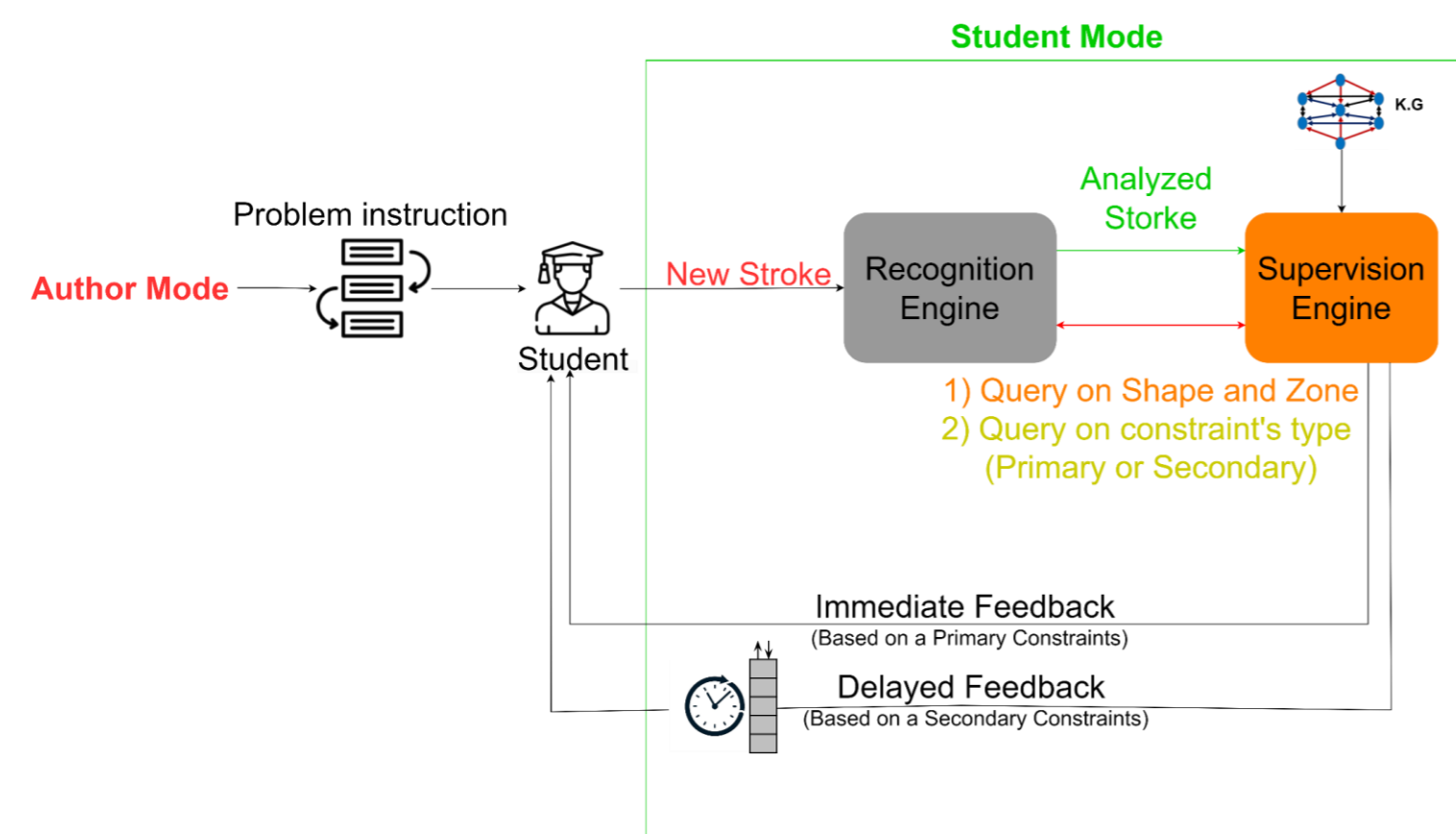
- ✓ **Recognition:** Not Essential (Evaluate detail)
- ✓ **Feedback:** Delayed qualitative feedbacks
- ✓ **Learning Impact:** Enhances skills
- ✓ **Examples:** Fine details constraints
- ✓ **Tolerance:** High



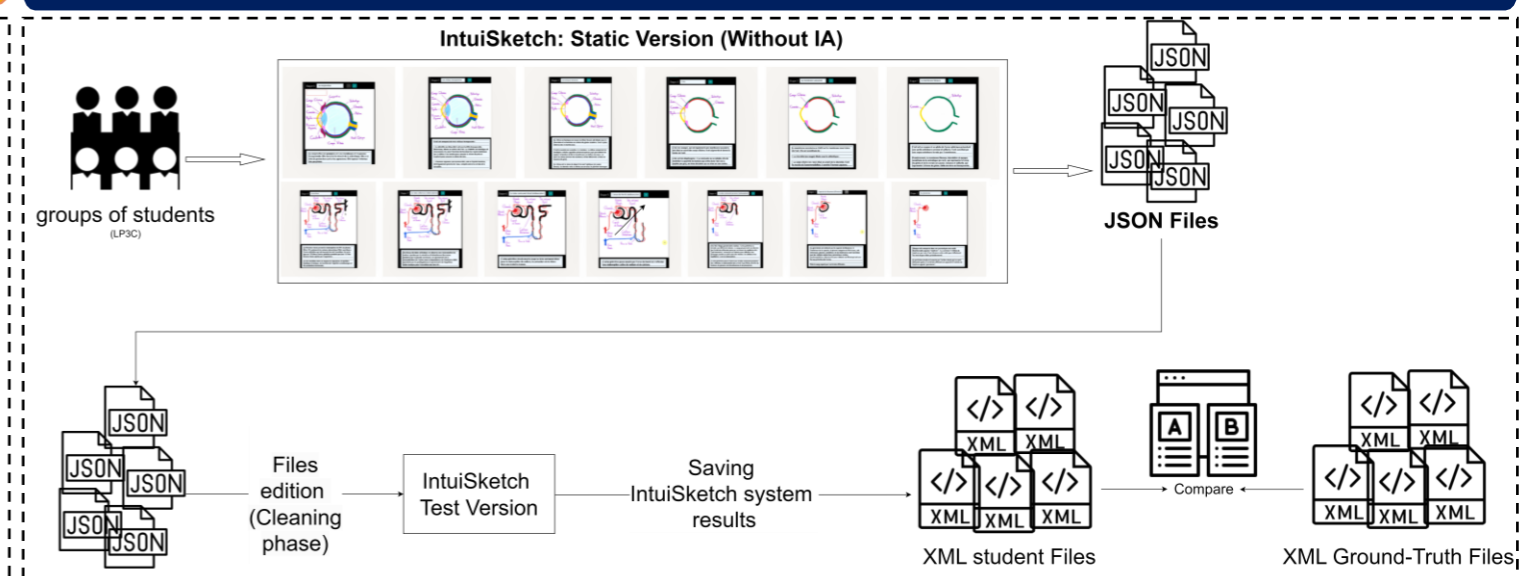
4. IntuiSketch's Balanced Supervision Engine

➔ **Categorisation into Immediate Feedbacks and Deferred Feedbacks.**

- Immediate feedbacks:** Provided in **real-time** to **correct major errors instantly** and related to **primary constraints**.
- Delayed feedbacks:** Given at **key stages** to **improve overall quality** and related to **secondary constraints**.



5. Experimental work (Test Protocol)



✓ Collaborated with **LP3C** for year-long tests on a **Static Version IntuiSketch**.

1. **7 test companies** on different anatomy exercises under different conditions were launched.
2. Students results were saved in **JSON files**.
3. Students work is tested on a **Test Version of IntuiSketch** after a **cleaning phase** to remove unusable traces.
4. **Retrieve results in XML files** and **create ground truth XML files** for each student's work.
5. Compare system results to ground truth to assess **tutor effectiveness**.