

Game-Based Evaluation of Uncertainty Visualization

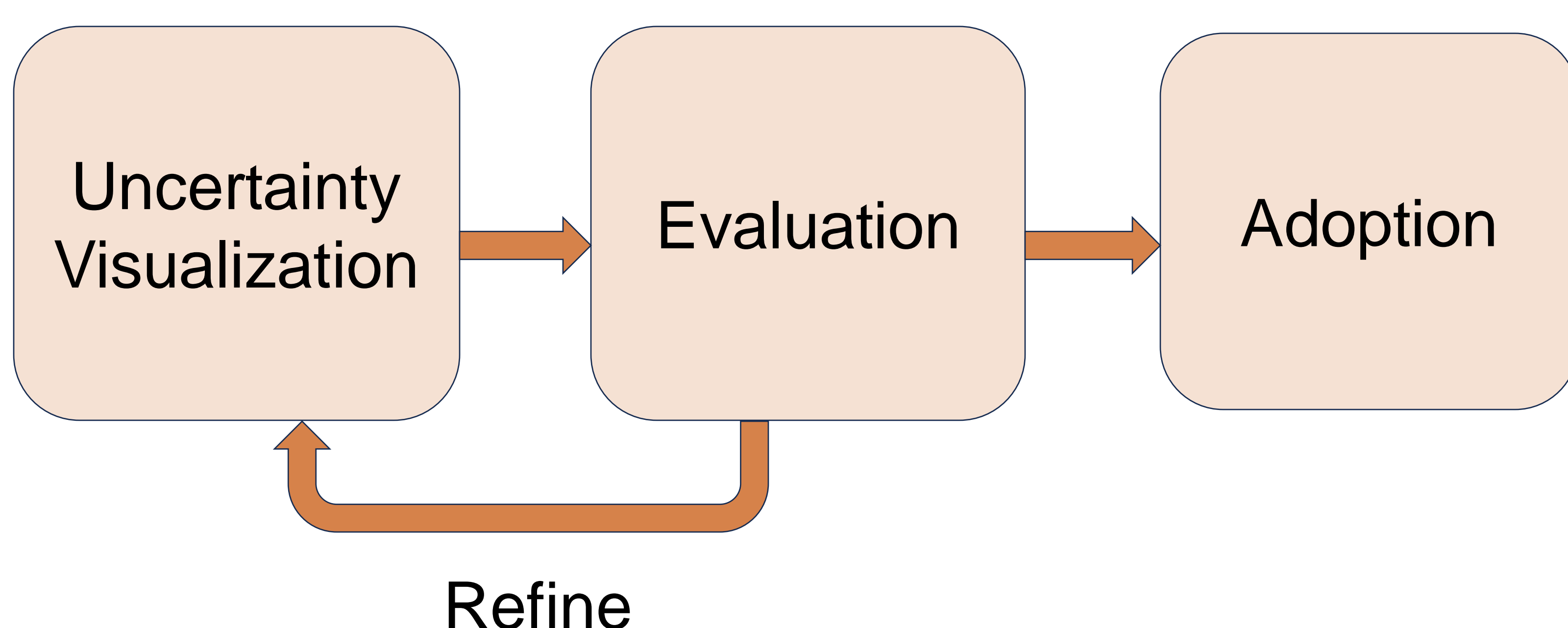
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Uncertainty Visualization Evaluation

There is strong interest in adopting uncertainty visualization in real-world settings, particularly in critical areas like tumor resection surgery. However, proper evaluation is essential to prove its effectiveness. We must validate these visualizations to ensure they are trusted before integrated into clinical practice.

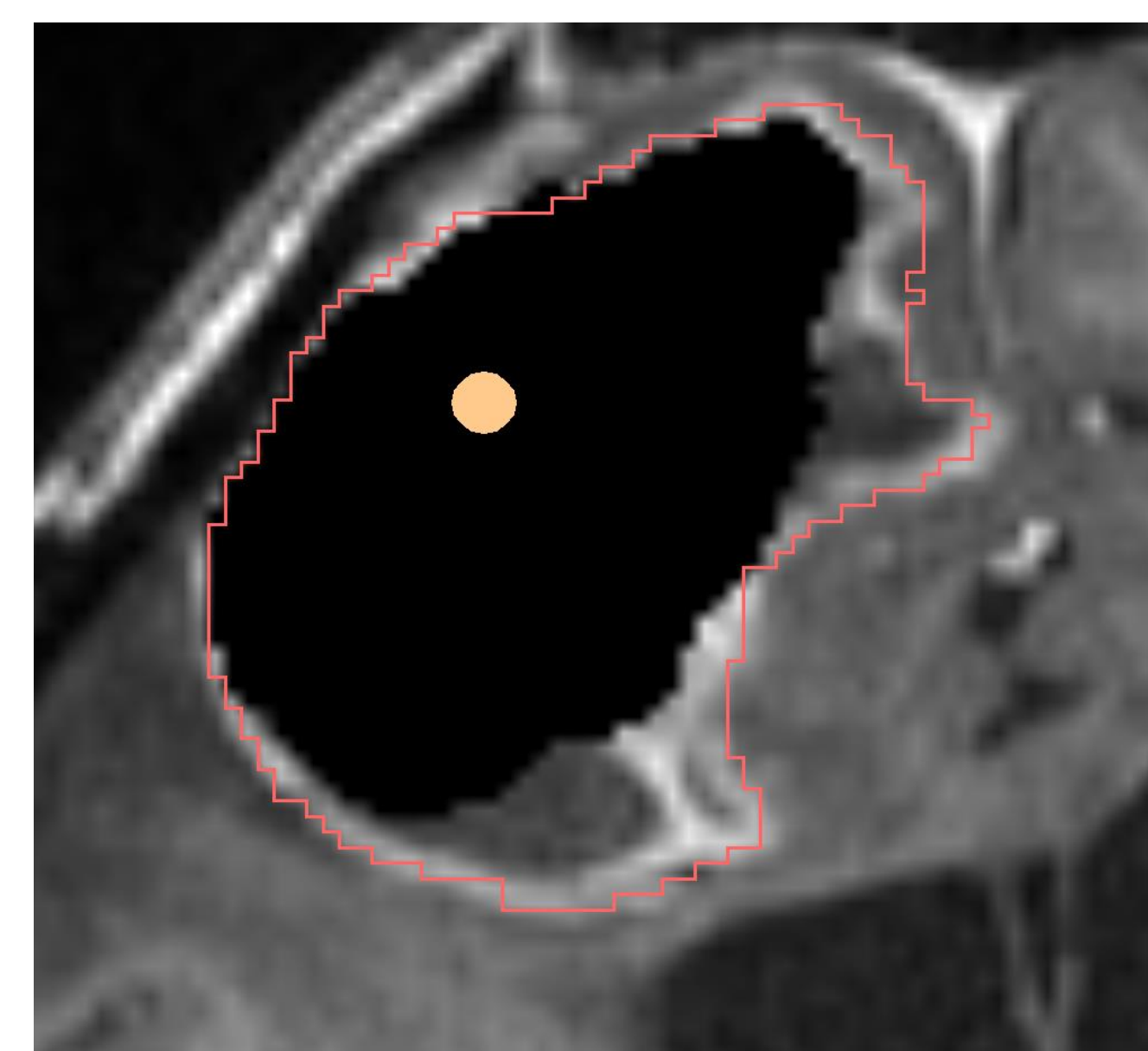
Traditional methods used to evaluate visualization, such as surveys and Likert scales, often fall short in capturing the true impact of uncertainty visualization on decision-making. These methods may not accurately reflect how uncertainty influences critical decision making in high-risk environments such as brain tumor surgery.



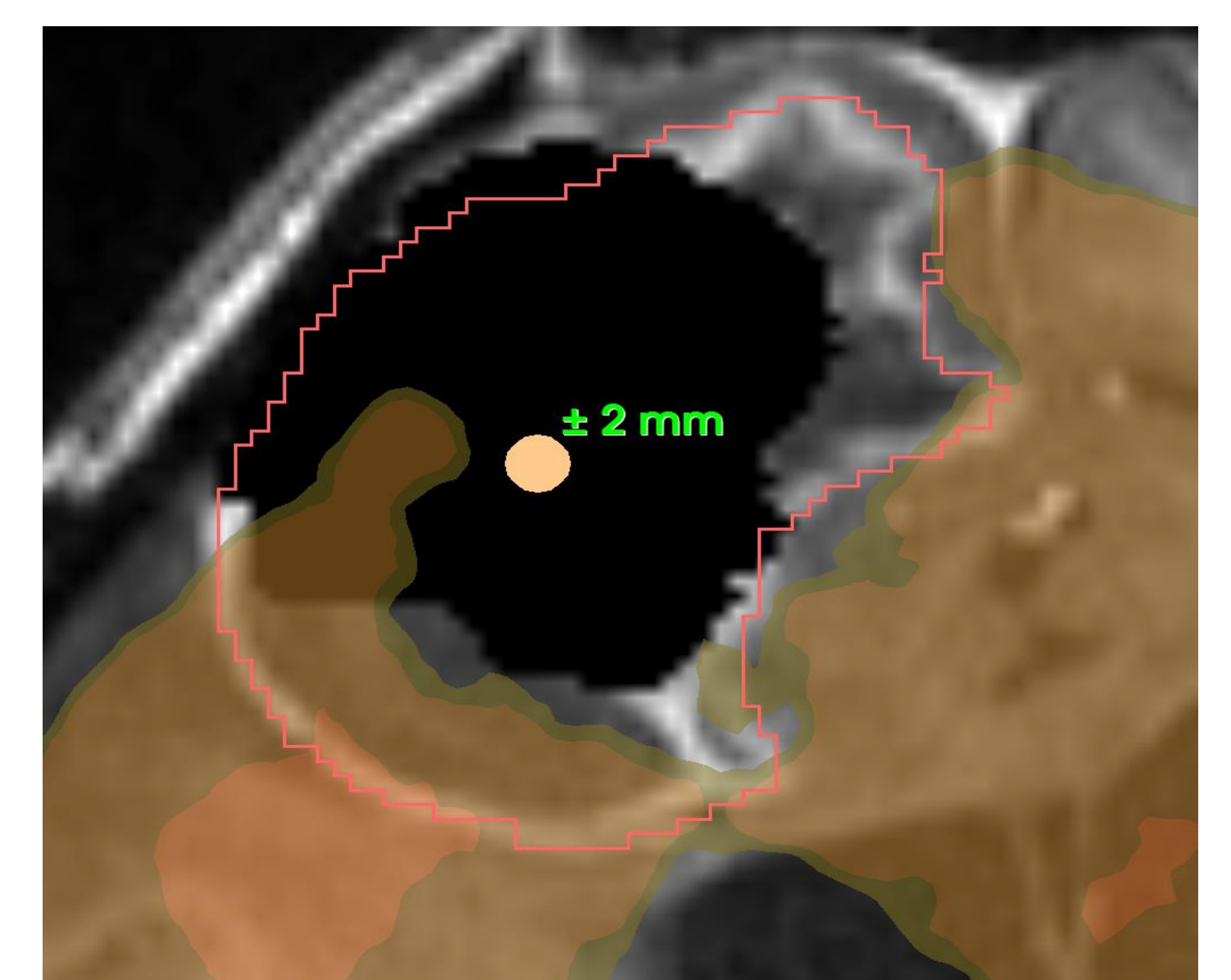
Without proper **evaluation**, the benefits of uncertainty visualization cannot be fully realized

Game-Based Approach

We developed a game-based approach to emulate the decision-making process during brain tumor resection. Users can explore different visualization techniques in the safe environment of the game to enhance their understanding of uncertainty. They are challenged to maximize tumor removal while preserving healthy tissue when the accuracy of the reference image is uncertain. Users are presented with a deformed image and must remove as much tumor as possible. Positive points are awarded for correctly removing tumor tissue, while negative points are given for removing healthy brain.



1



2

Users play in two steps: 1) First, they carve out tumor without uncertainty visualization to establish a baseline; 2) Then, they repeat the task with uncertainty visualization enabled

Score without Visualization: Score with Visualization:

+1160

-86

+1246

-16

After completing both steps, their scores are revealed, allowing them to see how the visualization has impacted their performance

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