m58773
[EE 13.50] Report on Triangle soup

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Overview

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Goal of EE13.50

- Study an extension of Trisoup to variable nodesize proposed in m57368.

Proposed Method in m57368

- maxTrisoupNodesize and minTrisoupNodesize are defined for each slice.
- Node size is determined by comparing parent with child cost values recursively from bottom to top.

Experimental results

- No new experimental result is reported as EE report.
- Results reported in the previous meeting re-ordered by new categories are introduced.

Related contribution

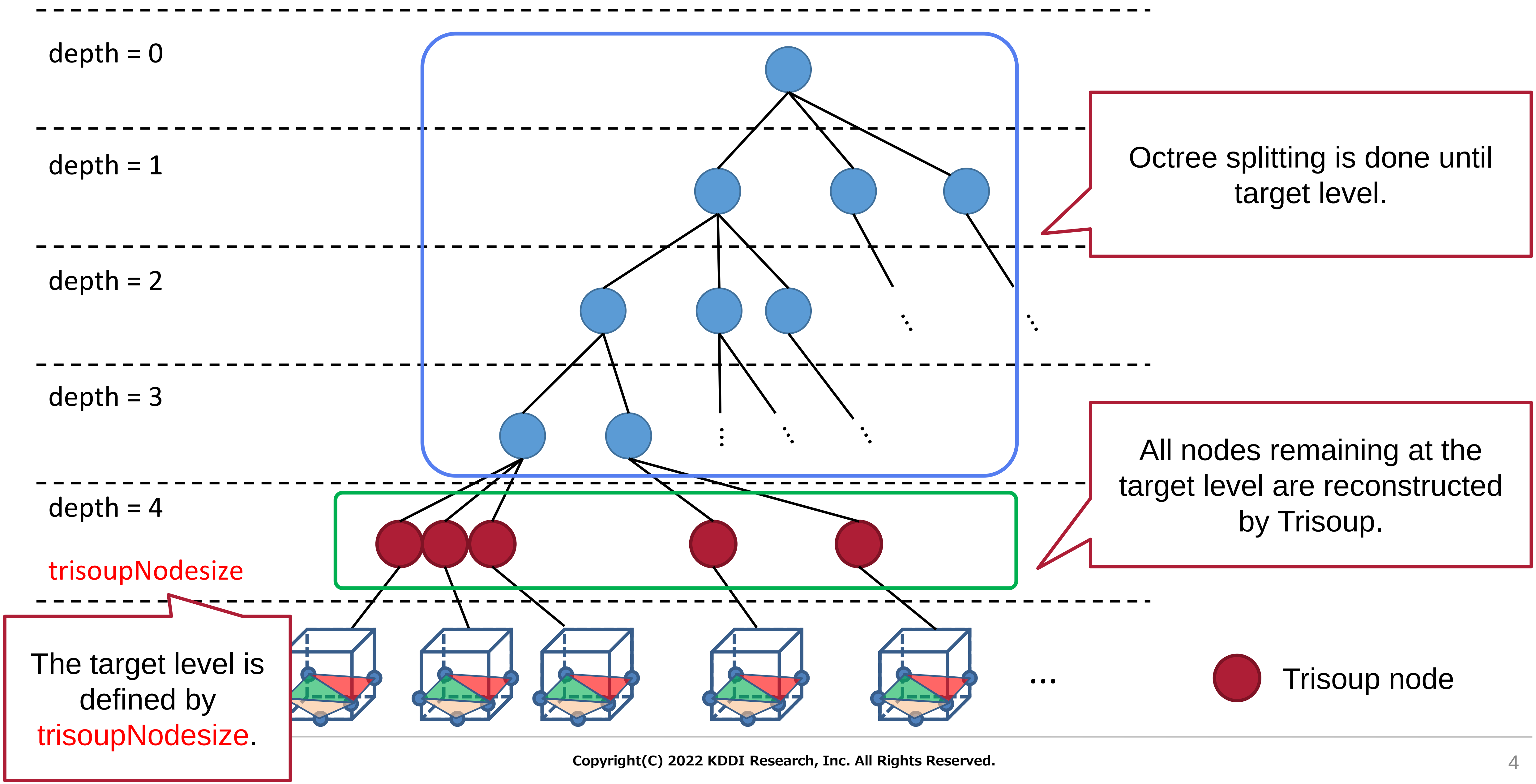
- Two contributions related subjective quality are input.
  - m58775: Refinement of Trisoup projection plane determination for improving subjective quality
  - m58776: Refinement of Trisoup variable node size extension for improving subjective quality

Background

- **Problem statement**
  - **Current Trisoup can choose only one node size for a slice.**
  - **It was mentioned in the previous meeting that variable node size is desired.**

- **Proposal**
  - **An extension of Trisoup to variable node size.**

Over view of current method (fixed node size)



Over view of proposed method (variable node size)

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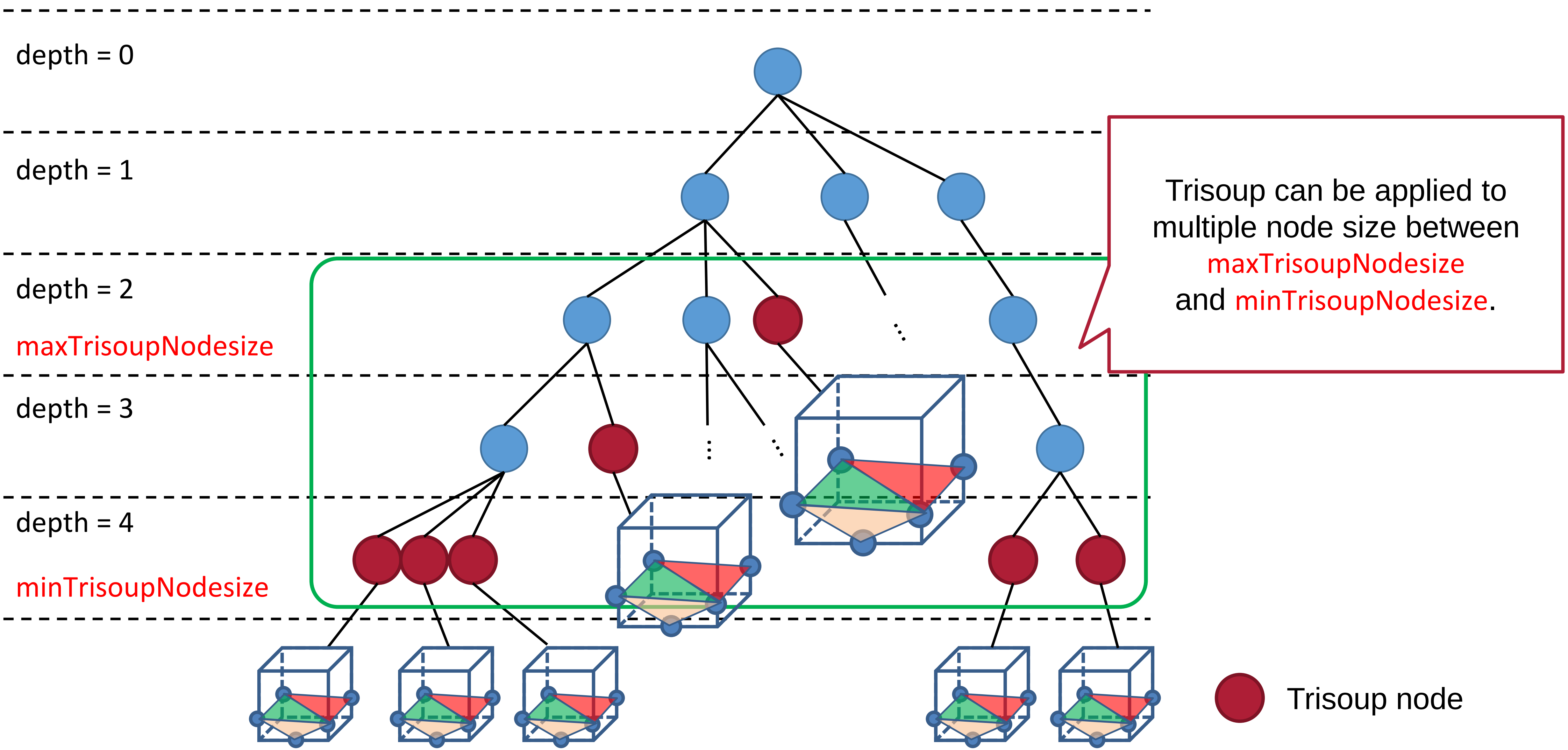

Proposed node size determination (encoder)

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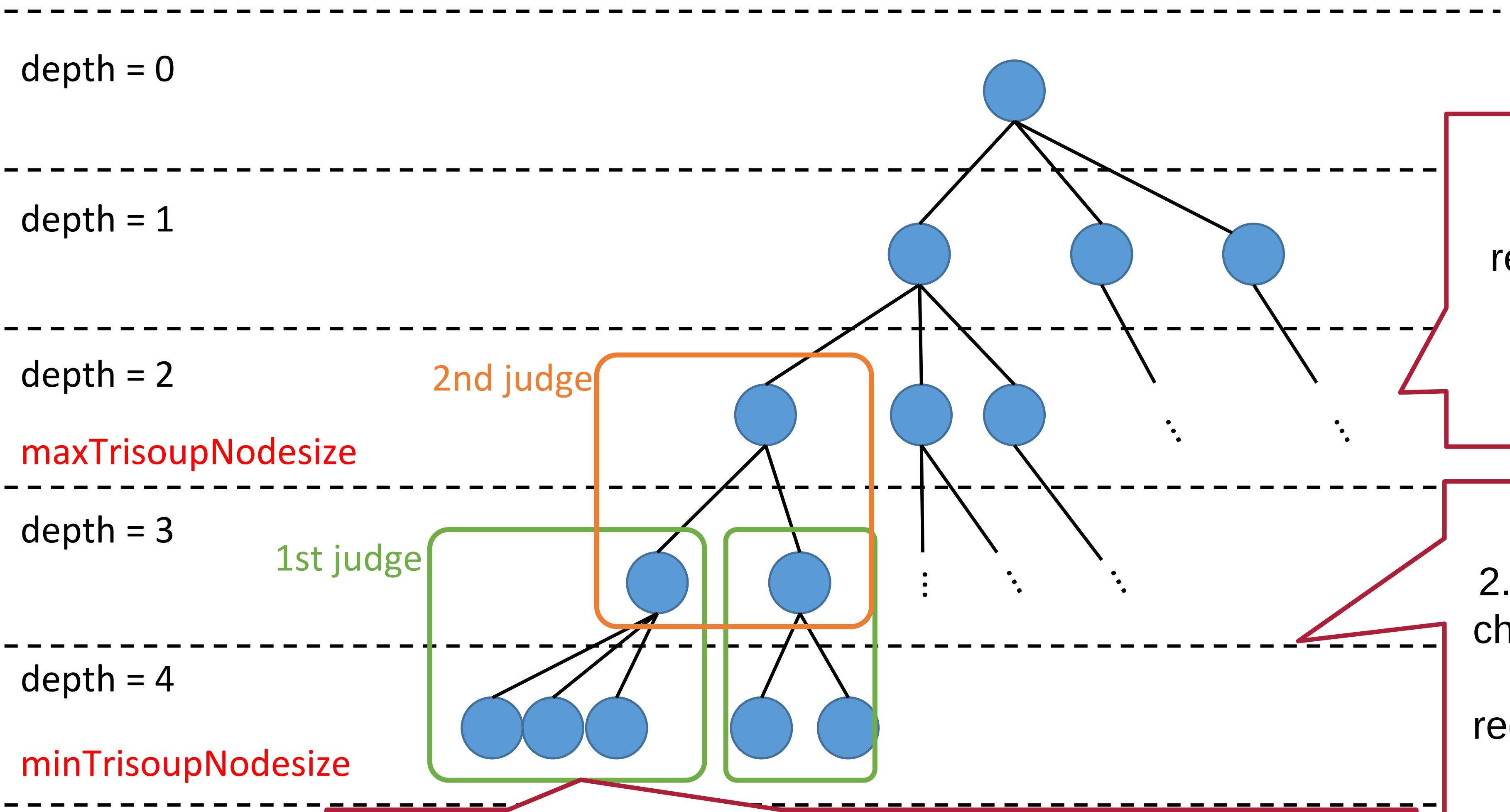
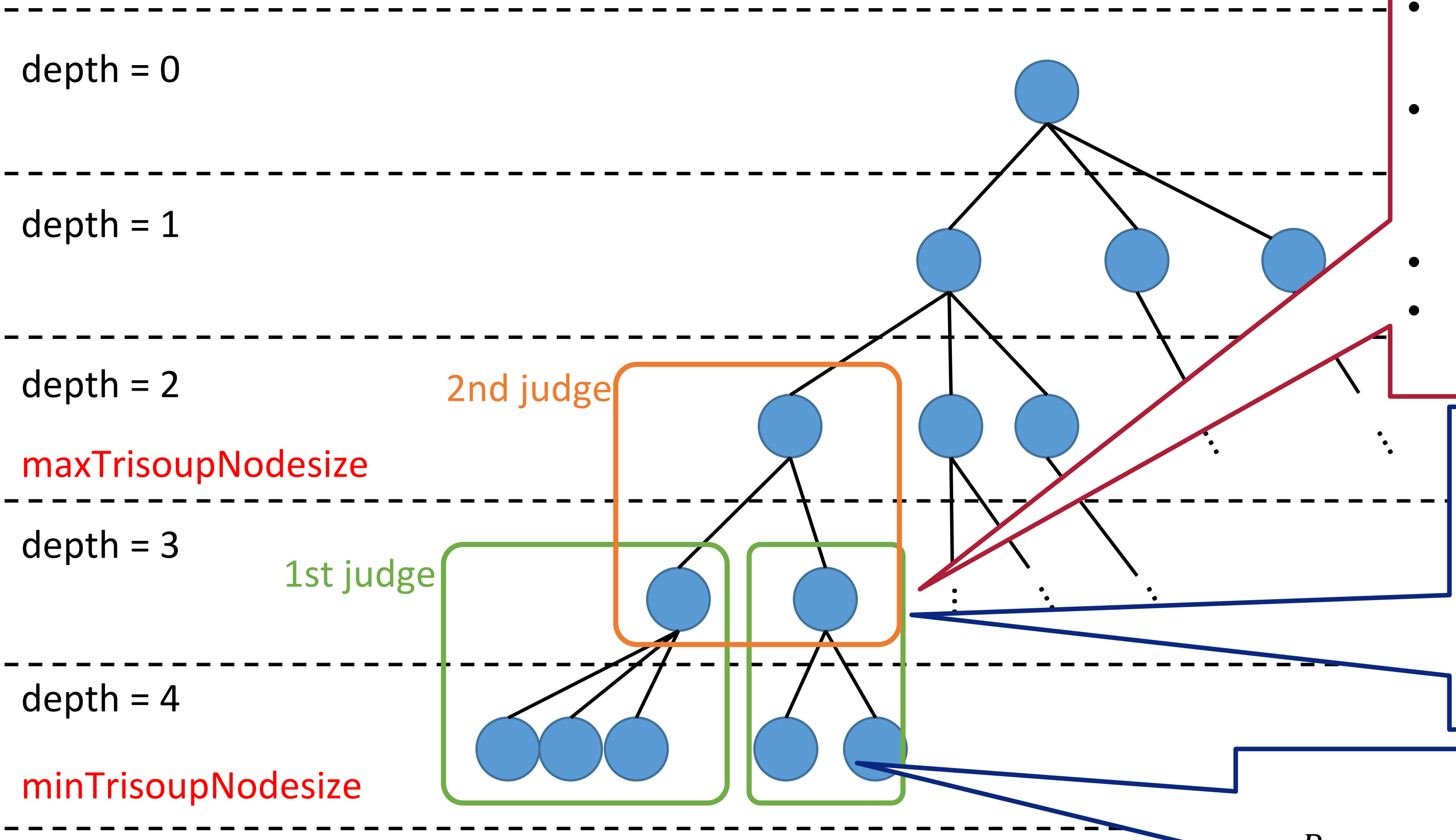


1. Point clouds are reconstructed by single-level Trisoup for each depth, respectively.

2. Costs of a parent node and child nodes are compared and retain lower cost nodes recursively from bottom to top.

In this report, four variations of cost function are tested.
(1) D1 MSE, (2.1) D1+D2, (2.2) D1+4*D2, (3) D1+4*D2+λR

Bits amount of side information (R) estimation (encoder)



- Compare $D_{parent} + \lambda R_{parent}$ with $D_{children} + \lambda R_{children}$
- If parent node is retained, R_{parent} is retained to upper layer (to use at 2nd judge).
- Otherwise, $R_{children}$ is retained.
- R_{parent} and $R_{childern}$ is roughly estimated as fixed length coding.

For parent:

$$R_{parent} = B_{flag} + B_{seg} + B_{pos}$$

$$\begin{cases} B_{flag} = 1 \\ B_{seg} = 12 \\ B_{pos} = n \cdot NodeSizeLog2 \end{cases}$$

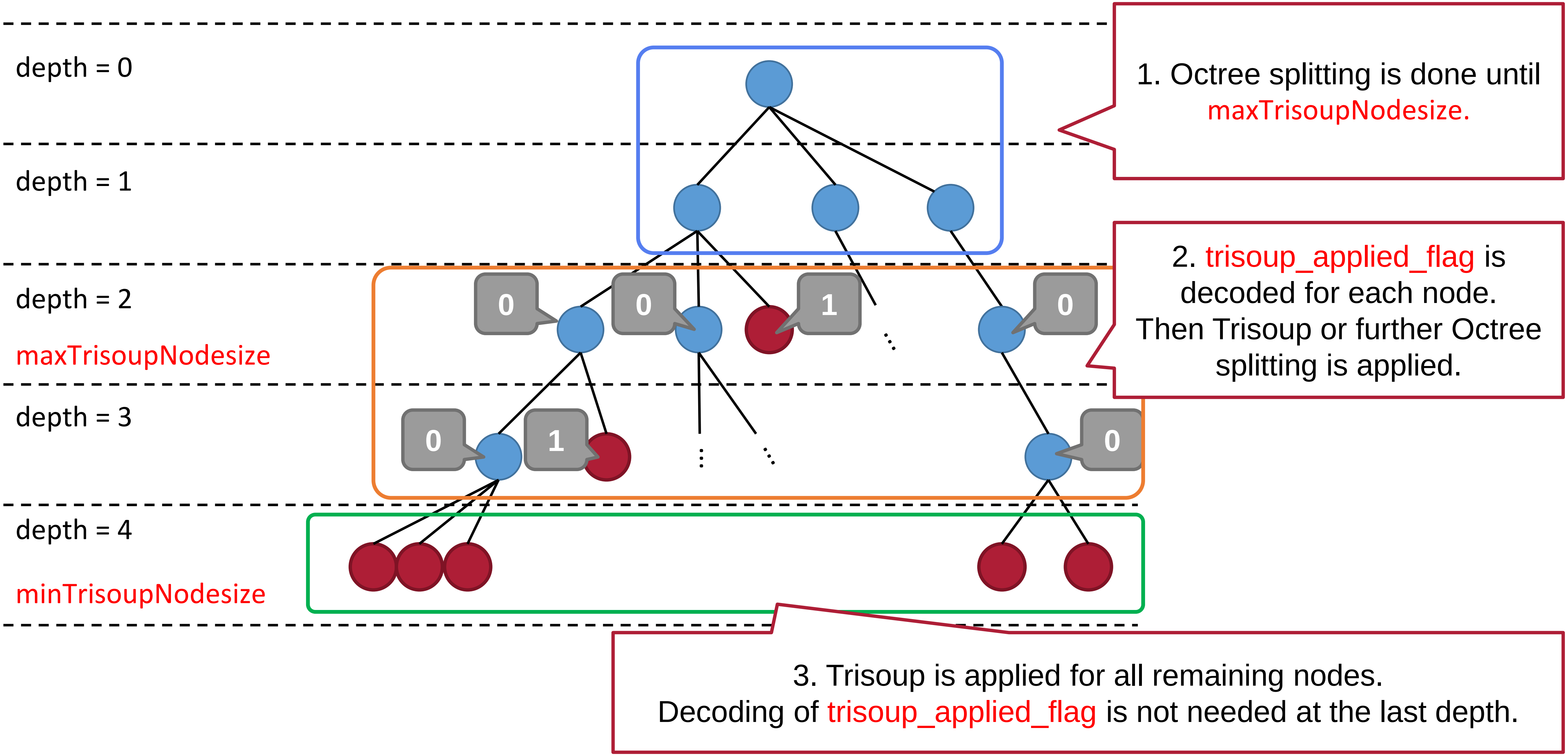
n: number of vertices on a node

For children:

$$R_{childern} = B_{flag} + B_{occ} + \sum_{i \in All\ child\ nodes} R_i$$

$$\begin{cases} B_{flag} = 0\ (minTrisoupNodesize), 1\ (otherwise) \\ B_{occ} = 8 \end{cases}$$

Proposed decoding process



Experiments (completely same as the previous meeting)

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■ Conditions

- Anchor : TMC13-v14.0
- Test : TMC13-v14.0 + Proposed method
- Trisoup – RAHT (Only C2 condition, Cat1 Sequences)

■ Node size settings

- In the test method, node size can be chosen among CTC and CTC+1.

Method	Node size log2			
	r01	r02	r03	r04
Anchor (CTC)	5	4	3	2
Test (node size = CTC & CTC+1)	6, 5	5, 4	4, 3	3, 2

■ Cost function

- D1 MSE: Symmetrical,
- D2 MSE: Asymmetrical (only use original normal data) as same as [3]
- In test 2.2, D2 MSE is multiplied by four
  - D1 MSE is roughly four times larger than D2 in CTC.
- λ is heuristically set as {372.0, 26.0, 1.8, 0.12} for {r01, r02, r03, r04}.

Test	Cost function
1	$D1$
2.1	$D1 + D2$
2.2	$D1 + 4 * D2$
3	$D1 + 4 * D2 + \lambda R$

Experimental results with new categories

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- Test result for each sequence is completely same as the previous meeting.
- Variable node size seems to be more efficient for sparser categories.

Test 1 : Cost = D1

C2_ai	lossy geometry, lossy attributes [all intra] Geom. BD-TotGeomRate [%] D1	D2
Solid average	0.0%	3.1%
Dense average	−1.2%	4.6%
Sparse average	−2.1%	12.2%
Scant average	−2.9%	8.2%
Overall average	−1.7%	7.1%
Avg. Enc Time [%]	196%	
Avg. Dec Time [%]	103%	

Test 2.1 : Cost = D1 + D2

C2_ai	lossy geometry, lossy attributes [all intra] Geom. BD-TotGeomRate [%] D1	D2
Solid average	−0.1%	1.9%
Dense average	−1.4%	3.3%
Sparse average	−2.0%	9.0%
Scant average	−3.0%	5.5%
Overall average	−1.8%	4.9%
Avg. Enc Time [%]	196%	
Avg. Dec Time [%]	102%	

Test 2.2 : Cost = D1 + 4 * D2

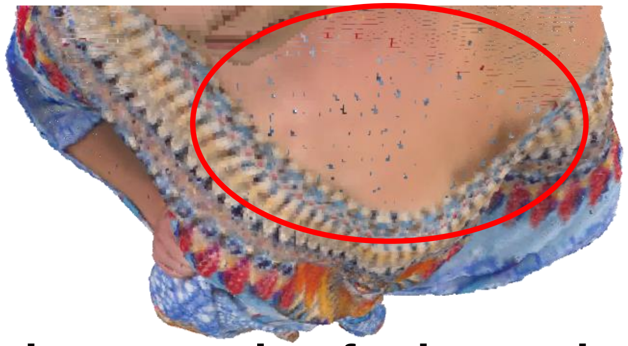
C2_ai	lossy geometry, lossy attributes [all intra] Geom. BD-TotGeomRate [%] D1	D2
Solid average	0.1%	1.0%
Dense average	−1.4%	2.2%
Sparse average	−1.6%	4.7%
Scant average	−2.6%	2.4%
Overall average	−1.5%	2.5%
Avg. Enc Time [%]	196%	
Avg. Dec Time [%]	101%	

Test 3 : Cost = D1 + 4 * D2 + λR

C2_ai	lossy geometry, lossy attributes [all intra] Geom. BD-TotGeomRate [%] D1	D2
Solid average	−0.3%	2.7%
Dense average	−7.6%	0.7%
Sparse average	−8.4%	1.5%
Scant average	−11.0%	−0.9%
Overall average	−7.5%	0.7%
Avg. Enc Time [%]	195%	
Avg. Dec Time [%]	97%	

Study on subjective quality impact

- **Two related contributions are input**
  - **m58775: Refinement of Trisoup projection plane determination for improving subjective quality**
    To solve visual “holes” for fixed node size.



  - **m58776: Refinement of Trisoup variable node size extension for improving subjective quality**
    To solve visual “gaps” for variable node size.

- **Details will be presented in MPEG week.**

Conclusion

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- **Goal of EE13.50**
  - **Study an extension of Trisoup to variable nodesize proposed in m57368.**
- **Proposed Method in m57368**
  - **maxTrisoupNodesize and minTrisoupNodesize are defined for each slice.**
  - **Node size is determined by comparing parent with child cost values recursively from bottom to top.**
- **Experimental results**
  - **No new experimental result is reported as EE report.**
  - **Results reported in the previous meeting re-ordered by new categories are introduced.**
- **Related contribution**
  - **Two contributions related subjective quality are input.**
    - m58775: Refinement of Trisoup projection plane determination for improving subjective quality
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- **Recommendation**
  - **Review the above related contributions in MPEG week.**