A FORMAT-COMPLIANT SELECTIVE SECRET 3D OBJECT SHARING SCHEME BASED ON SHAMIR'S SCHEME

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INTRODUCTION

Multimedia security **allows** users to **protect** content from illegal access by **preserving** the **format compliance**.

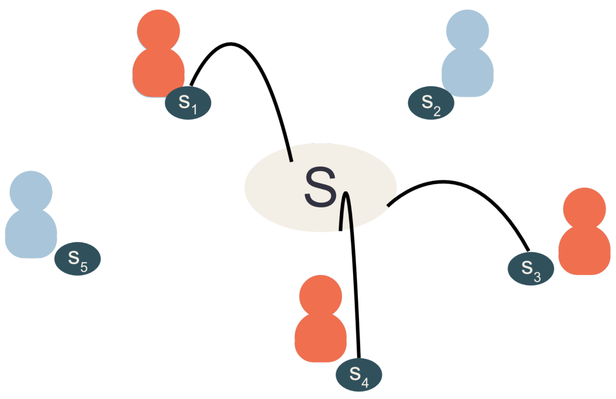
3D selective encryption allows owners to distribute protected 3D contents **as they see fit** to transmit to third-parties [1].

The **need** to **share** 3D content in a **secure** manner has arisen in recent **collaborative** and cloud-based environments, such as **3D workflows**.

We propose a **selective secret 3D object sharing scheme based on Shamir's Secret Sharing scheme** to protect 3D content and share low quality 3D objects as shares.

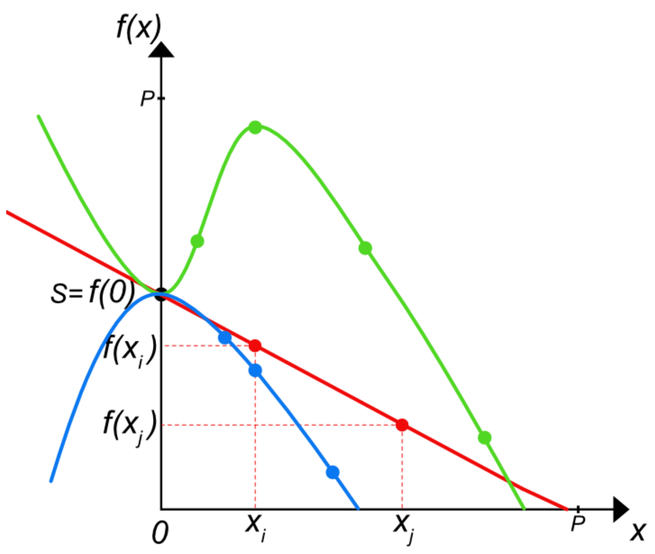
SECRET SHARING

- Keyless approach.
- (*k, n*)- threshold scheme.
- Share a secret among *n* users.
- Reconstruct secret with *k* users (among the *n)*.

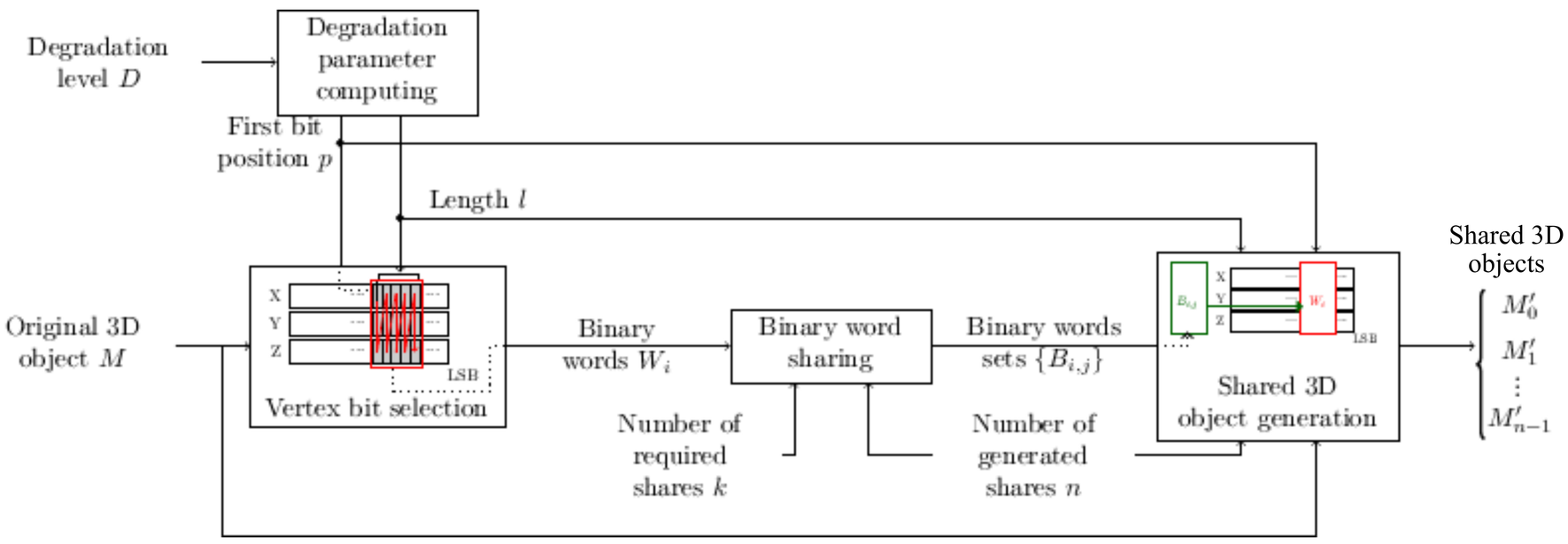


SHAMIR'S SCHEME

- First scheme in 1979 [2].
- Secret is defined on finite field.
- Shares can be considered as **2D points**.
- The secret is reconstructed using a polynomial interpolation (Lagrange's interpolation).

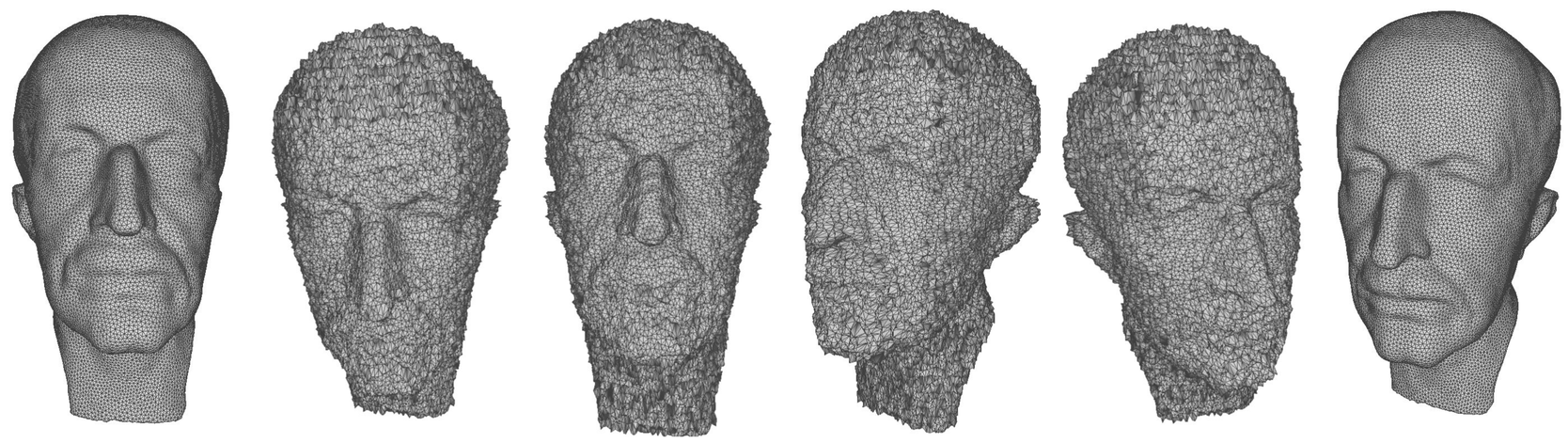


OVERVIEW OF THE METHOD



Degradation level *D* parameters: *p* between 0 and 22, *l* between 1 and (*p*+1).

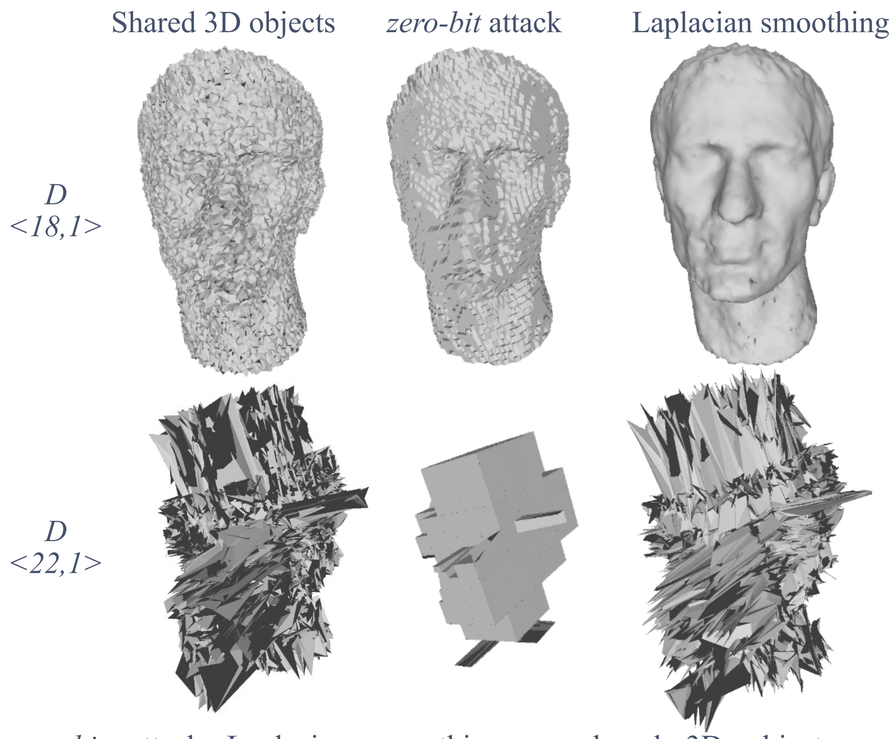
EXPERIMENTAL RESULTS



Original 3D object | *Shared 3D object* M'_0 | *Shared 3D object* M'_1 | *Shared 3D object* M'_2 | *Shared 3D object* M'_3 | *Reconstructed 3D object*

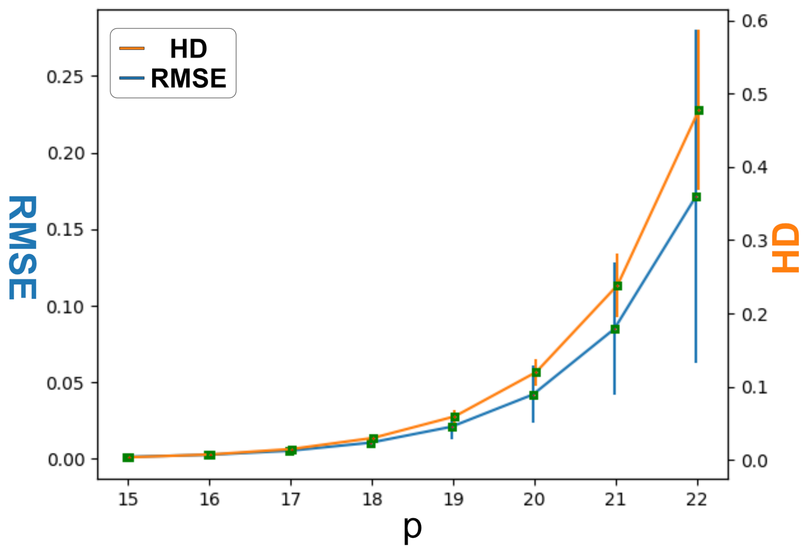
Sharing experiment with parameters *k=3*, *n=4* and *D=<18,19>*.

GEOMETRIC ATTACKS



zero-bit attack Laplacian smoothing on shared 3D objects depending on the degradation level *D=<18, 1>* and *D=<22,1>*.

EVALUATION



Mean and standard deviation of the RMSE and the Hausdorff Distance on the Princeton mesh segmentation dataset [3] as a function of the degradation level (*D=<p, p+1>*).

COMPARISON

Scheme	[4]	[5]	[6]	[7]	[8]	**Proposed**
Meaningful	✗	✗	✗	✓	✓	✓
Lossless	✗	✗	✓	✓	✗	✓
Multiple	✗	✓	✓	✗	✓	✗
Non expansive	✓	✗	✓	✗	✗	✓
Format-compliant	✗	✗	✓	✓	✓	✓
Selective	✗	✗	✗	✗	✗	✓

Comparison of our scheme with previous work.

CONCLUSION

- We proposed a efficient **format-compliant selective secret 3D object sharing** scheme based on Shamir's scheme. We share a 3D object and *n* low and controllable quality shared 3D objects distributed to users which can reconstruct the secret 3D object **perfectly** with *k* of them.
- We introduced the **first selective** secret 3D object sharing scheme which **allows** users to define the **level of degradation** assigned to the shared 3D objects before the sharing step.
- Experimental results show the feasibility of our scheme and the robustness against geometric attacks.
- Future work will concentrate on adding new features to our secret 3D object sharing scheme, for example **hierarchical** aspect in order to control the access to 3D content depending on the hierarchy among users in collaborative 3D workflows.

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