**Super-Resolution Screen Space Irradiance Sampling for Lightweight Collaborative Web3D Rendering Architecture**

*Huzhiyuan Long1*, *Yufan Yang1*, *Chang Liu2*, *Jinyuan Jia1*

1. Tongji University 2. Nanchang Hangkong University

*Email: huzhiyuan.long@outlook.com*

---

**System Architecture**

- **Server rendering**
  - Compute irradiance (irradiance sampling)
  - Transmit LR irradiance
  - H.264 streaming

- **Client reconstruction**
  - Compute irradiance
  - HR G-buffer
  - Super-Resolution
  - G-buffer guided filter
  - HR irradiance

---

**Background**

- For cloud rendering, it requires high server computing and transmission costs.
- Collaborative rendering makes full use of the computing power of the client devices, which is a rendering system that computes indirect lighting on the server, direct lighting on the client, and blends them to output.
- For previous collaborative rendering, it requires high performance requirements on client device.

**Our method**

- Inspired by Shao W et al.1, it is feasible to only use the screen space illumination information. We render and transmit lower resolution irradiance (comprising both direct and indirect lighting) on the server, and then reconstruct the image through super-resolution on the client.
- To improve the super-resolution effect, we use a separately-rendered-in-negligible-time original resolution G-buffer to guide the reconstruction.2

**Result**

- Ideally, our real-time super-resolution effect can achieve state-of-the-art level, thanks to the original resolution G-buffer guidance.
- As for 3x3 upsampling, it can save an average of 66% bandwidth (compared to streaming original resolution frames) and 67% computational consumption (measured by GPU time).

**Acknowledgements**

National Natural Science Foundation of China (No.U19A2063, No.62072339, No.62262043)

**References**