A Survey of Spherical Videos with an Emphasis on Spherical Projections

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Demo Overview

1. What are Spherical Videos?
2. Spherical Projections
   a. Equirectangular
   b. Cubemap
   c. Pyramid
3. Video Examples of Projections
4. Conclusion

What are Spherical Videos?

- Commonly called “360 Videos”
- Video projected into a sphere around the viewer
- 3 Degrees of Freedom while viewing
- Encodings and file types are the same as regular videos
  - It’s all in the metadata

Spherical Projections

View Port Independent

- Attempt to encode whole video at uniform quality
  - Needs a very high bitrate and resolution
- Allows for more immersive experience
- Equirectangular, cubemap

View Port Dependent

- Encode a section of video with more info than the rest
  - Achieve a lower bitrate
- Great if only one section has action
  - Other view ports will be severely reduced in quality
- Pyramid

Equirectangular

- Single image projected into the sphere
  - Quite simple
- Poles of the video are stretched and hold redundant info
- Often seen in flat world maps
  - Antarctica being way bigger than normal
- Supported by both MPEG's OMAF and Google's Spatial Media standards

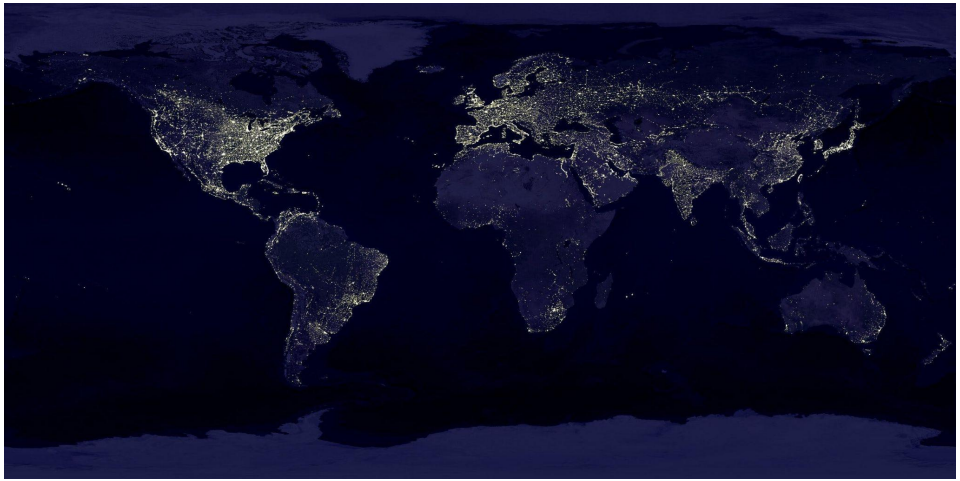

Figure 1: Equirectangular Projection of Earth [1]

Cubemap

- Faces of a cube mapped to parts of a sphere
  - A little less simple
- Redundancy and distortion on edges of cube faces
- Supported by OMAF and Spatial Media

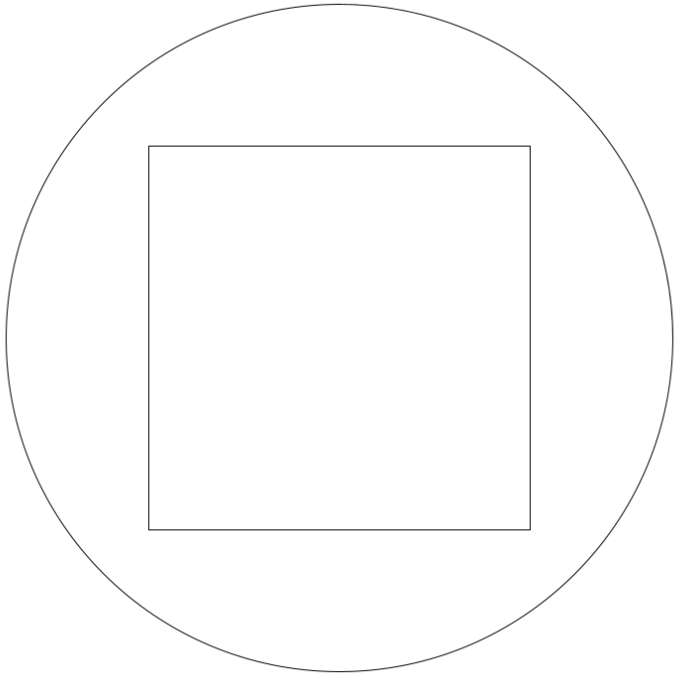

Figure 2: 2-Dimensional Cubemap Projection Diagram

Pyramid

- Viewport is projected from square face
  - Other parts are from the triangle faces of the pyramid
- Viewport gets good quality, rest of video is much lower
- Currently not supported by OMAF or Spatial Media
  - May be supported by other standards or platforms

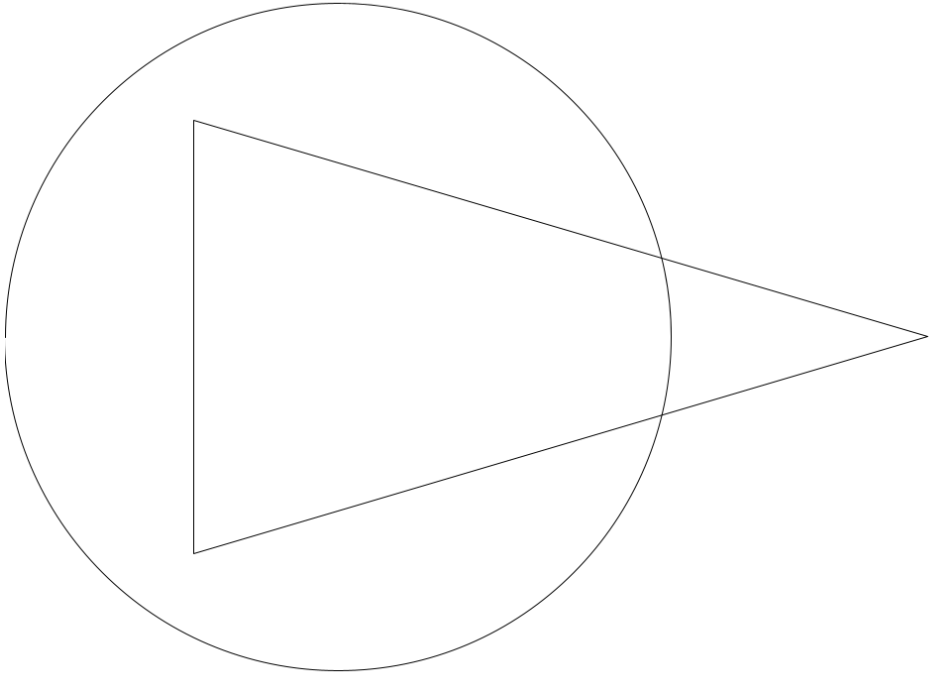

Figure 3: 2-Dimensional Pyramid Projection Diagram

Video Examples of Projections

Let’s have a look at some videos!

Conclusion

- Want to know more?
  - Check out some of the articles on my site!
- Want EVEN more than that?
  - The project report that will be released within a week after this demo will have even more!
- Still not enough?
  - Check out the references and tools I have used throughout the project!

References

General

[1] A. Yaqoob, T. Bi, and G. -M. Muntean, "A Survey on Adaptive 360° Video Streaming: Solutions, Challenges and Opportunities," *IEEE Communications Surveys & Tutorials*, vol. 22, no. 4, pp. 2801-2838, Jul. 2020, doi: 10.1109/COMST.2020.3006999.

[2] *Spatial Media - Spherical Video V2 RFC*. (2020), Google. Accessed: Dec. 3, 2023. [Source Code]. Available: https://github.com/google/spatial-media/blob/master/docs/spherical-video-v2-rfc.md

[3] M. M. Hannuksela and Y. -K. Wang, "An Overview of Omnidirectional MediA Format (OMAF)," *Proceedings of the IEEE*, vol. 109, no. 9, pp. 1590-1606, Sept. 2021, doi: 10.1109/JPROC.2021.3063544.

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[2] *FFmpeg*. (v6.1), FFmpeg. Accessed: Dec. 3, 2023. [Online]. Available: https://www.ffmpeg.org/

[3] *A-large-dataset-of-360-video-user-behaviour*. (2021), 360VidStr. Accessed: Dec. 3, 2023. [Source Code]. Available: https://github.com/360VidStr/A-large-dataset-of-360-video-user-behaviour/tree/main

[4] *Spatial Media Metadata Injector*. (2023), Google. Accessed: Dec. 3, 2023. [Source Code]. Available: https://github.com/google/spatial-media/tree/master/spatialmedia

[5] *VLC Media Player*. (v3.0.20). VideoLAN. Accessed: Dec. 3, 2023. [Online[. Available: https://www.videolan.org/vlc/