

# 3-D Time Varying Meshes Compression Via Key Frame Representation Based Geometry Video (KFRGV)

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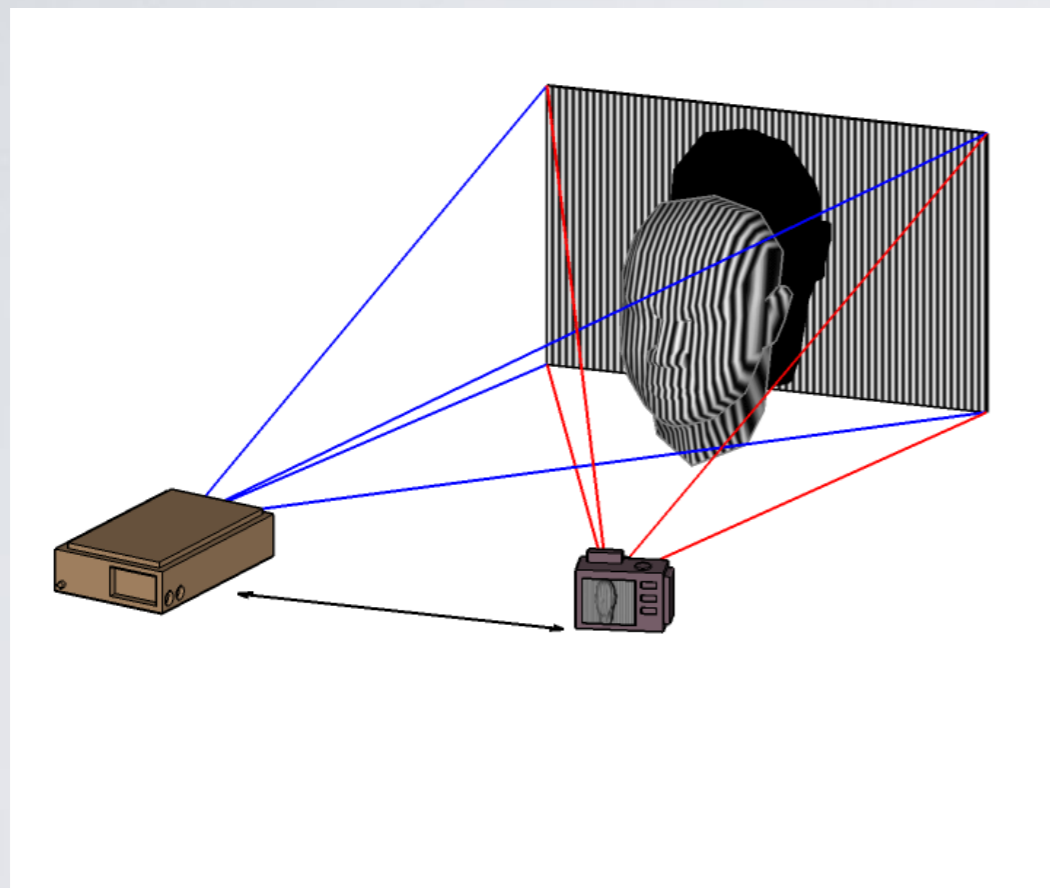
Prof. MAGNENAT-THALMANN Nadia, IMI

# Background and Motivation

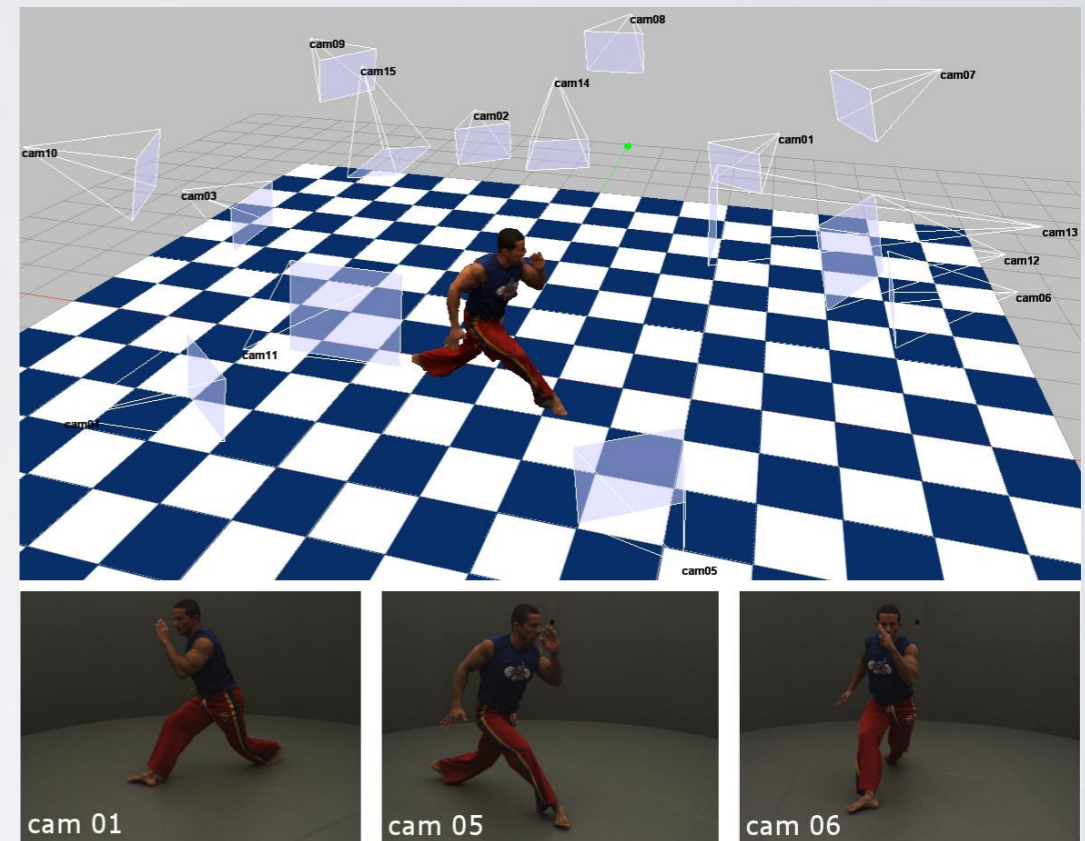
- Extensive application of 3-D dynamic meshes
  - video games, movie production
  - social media, virtual reality, etc.

# Background and Motivation

- 3-D scanning technology



**(a) Structured light system**



**(b) Multi-view system**

# Background and Motivation

- **Problem :**

- Huge datasize: 150MB raw data per second (30 fps and 250K) .
- Time-varying meshes: number of vertices and connectivity change from frame by frame.

# Outline

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- Related work

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- Proposed compression framework

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- Experimental results

4

- Conclusion

# 1. Related work

- Competition of dynamic mesh compression by IEEE SPS.
- Huawei/3DLife fast and efficient compression for TVM.
- extended block matching from 2D video to 3D TVM [1] [2]
- Remesh and spatiotemporal wavelet transform [3].

[1] I. Eckstein, M. Desbrun, and C.-C. Jay Kuo, "Compression of time varying isosurfaces", in *Proc. Graphics Interface*, pp. 99-105, 2006.

[2] S.-R. Han, T. Yamasaki, and K. Aizawa. Time-varying mesh compression using an extended block matching algorithm, *IEEE Trans. Circuits Syst. Video Technol.*, vol. 17, no. 11, pp. 1506-1518, 2007.

[3] J.-H. Yang, C.-S. Kim, S.-U. Lee, Semi-regular representation and progressive compression of 3-D dynamic mesh sequences, *IEEE Trans. Image Process.*, vol. 15, no. 9, pp. 2531-2544, Sep. 2006.

# 1. Related work

- geometry video (GV) based
  - Using 3-D shape and texture information [4].
  - Expression-invariant parameterization [5] [6].
  - Conformal geometry video[7].
  - Holovideo [9].

[4] H. Habe, Y. Katsura, and T. Matsuyama, "Skin-off: representation and compression scheme for 3D video", in *Proc. Picture Coding Symposium*, pp. 301-306, 2004.

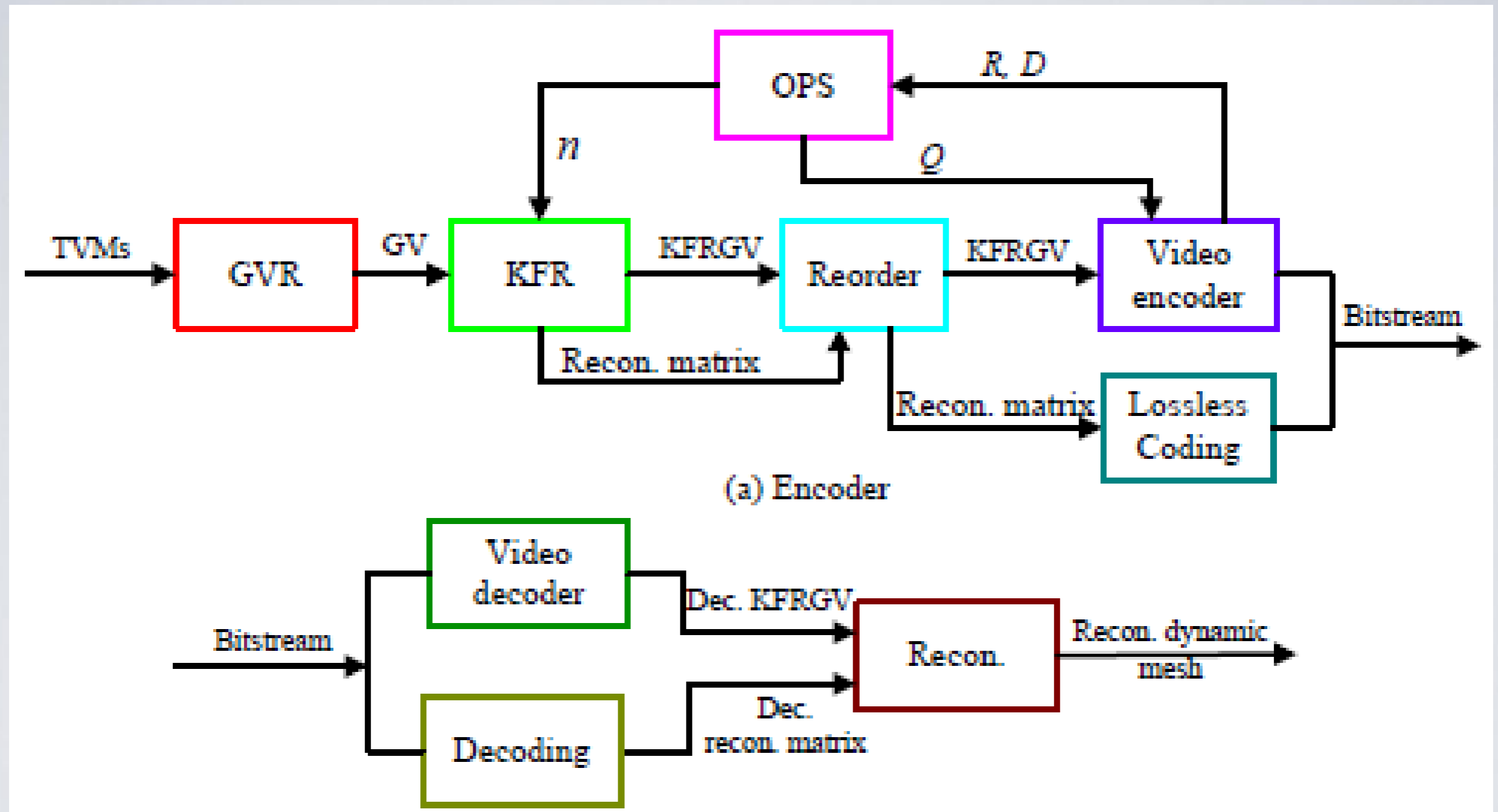
[5] J. Xia, Y. He, D. Quynh, X. Chen, and S.C. Hoi, "Modeling and compressing 3-D facial expressions using geometry videos, *IEEE Trans. Circuits Syst. Video Technol.*, vol. 22, no. 1, pp. 77-90, Jan. 2012.

[6] J. Hou, L.-P. Chau, Y. He, M. Zhang, N. Magnenat-Thalmann, "Rate-distortion model based bit allocation for 3-D facial compression using geometry video," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 23 no. 9, pp. 1537-1541, Sep. 2013.

[7] Dao. Quynh, Y. He, X. Chen, J. Xia, Q. Sun, and Hoi, Steven C.H, "Modeling 3D articulated motions with conformal geometry videos (CGVs)," in *Proc. ACM Multimedia*, pp. 383-392, 2011.

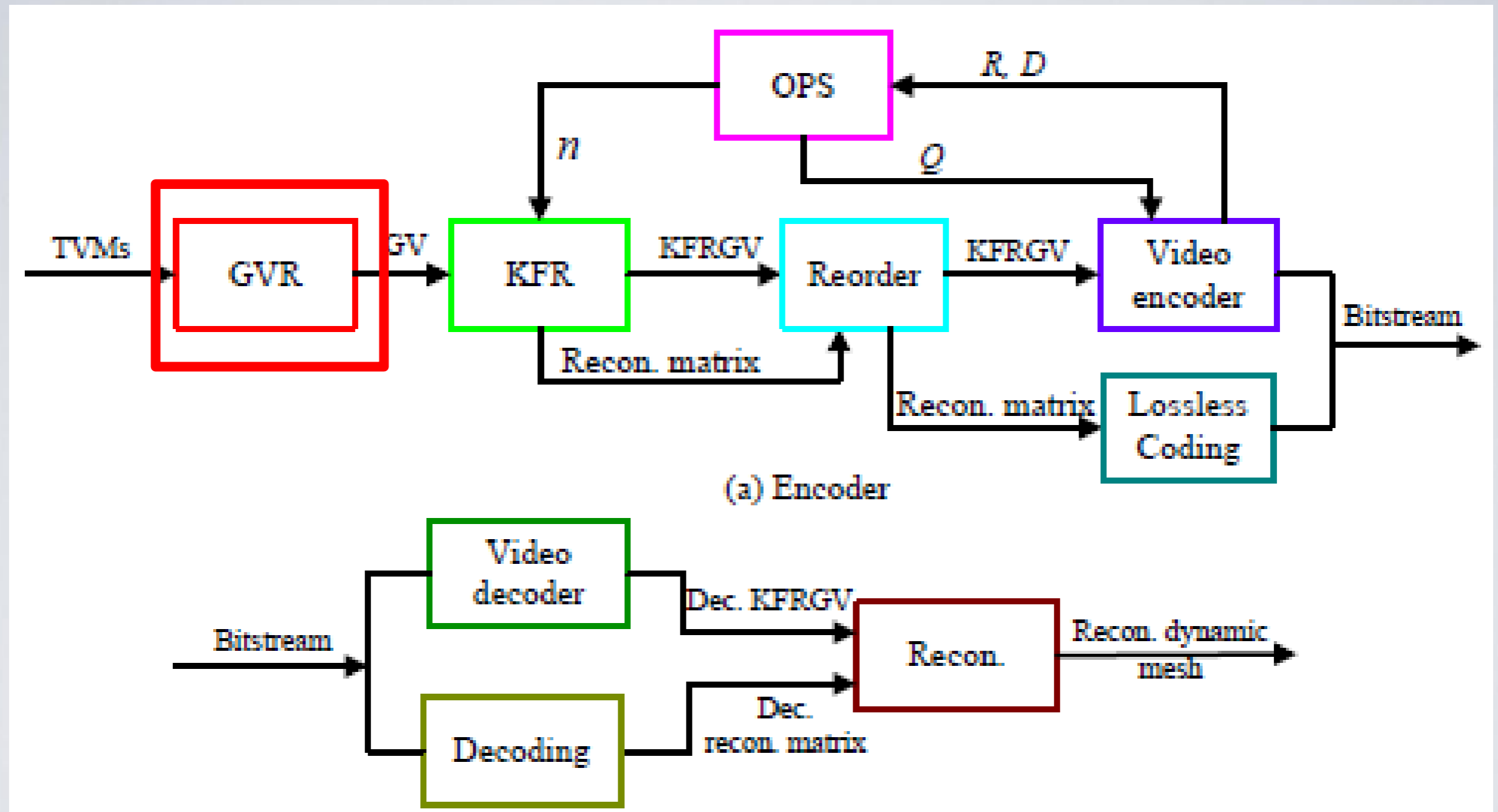
[8] N. Karpinsky, and S. Zhang, "Holovideo: Real-time 3D range video encoding and decoding on GPU," *Optics and Lasers in Engineering*, vol. 50, no. 2, pp. 280-286, 2012.

# 2. Proposed compression framework

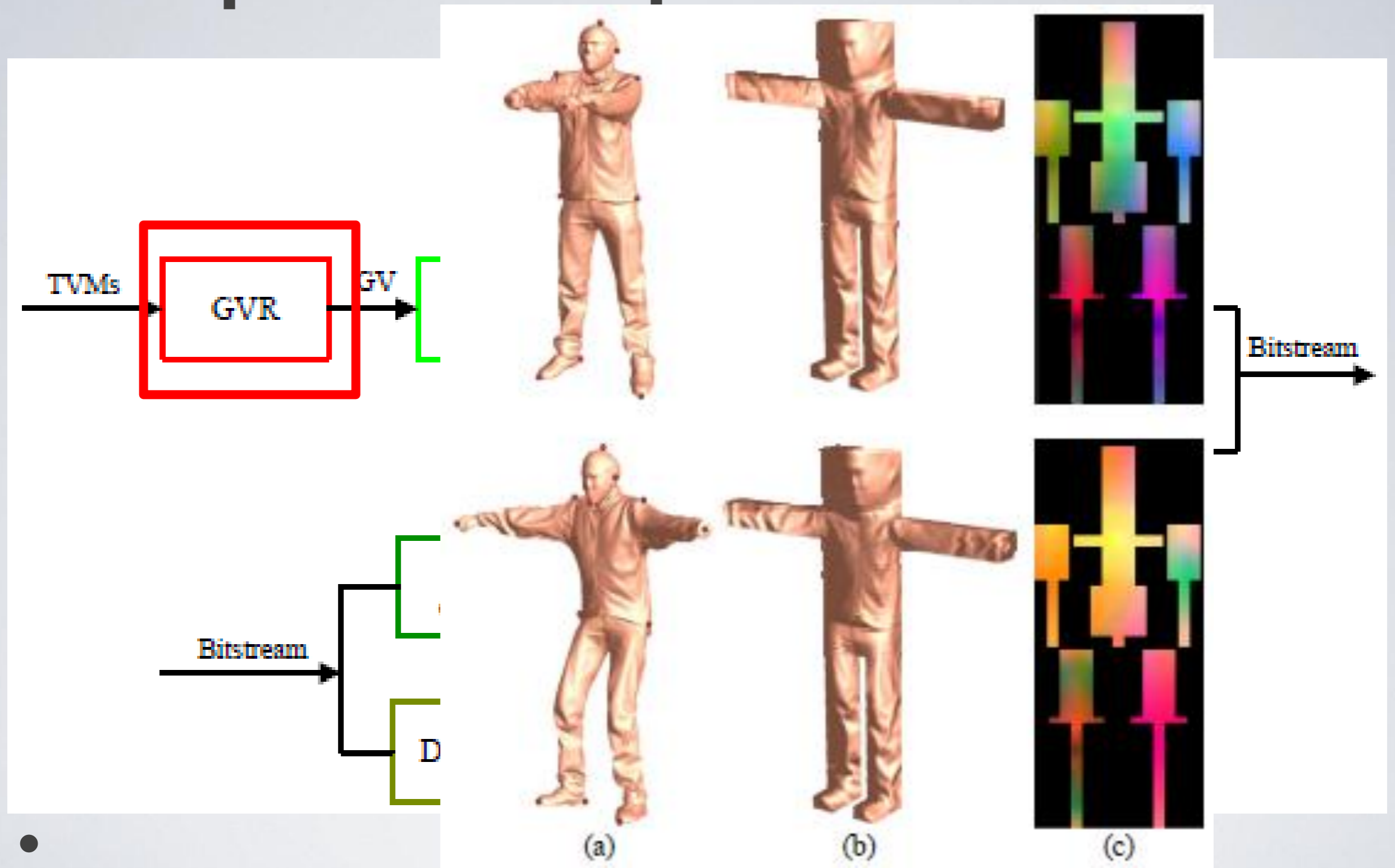




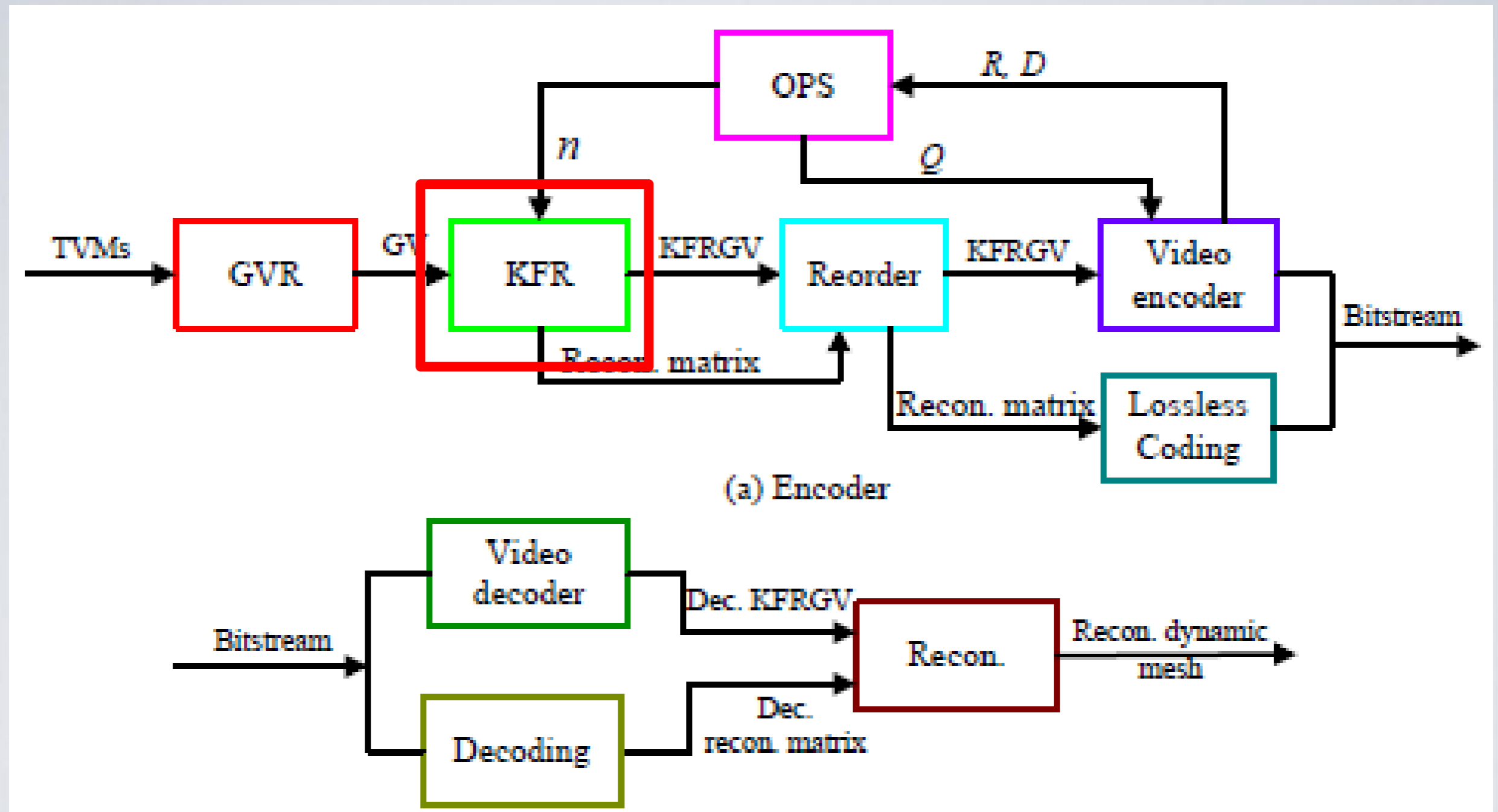
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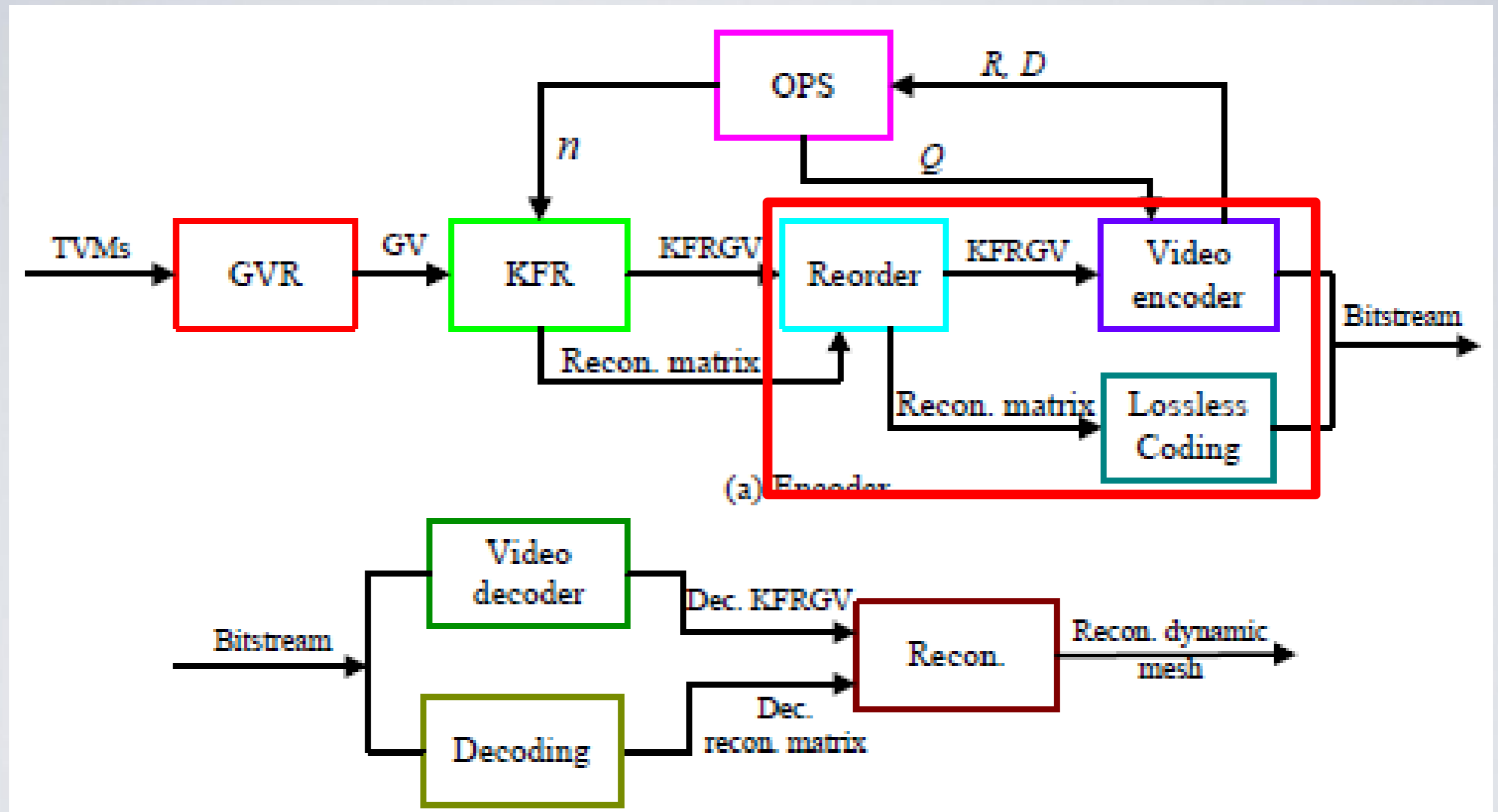
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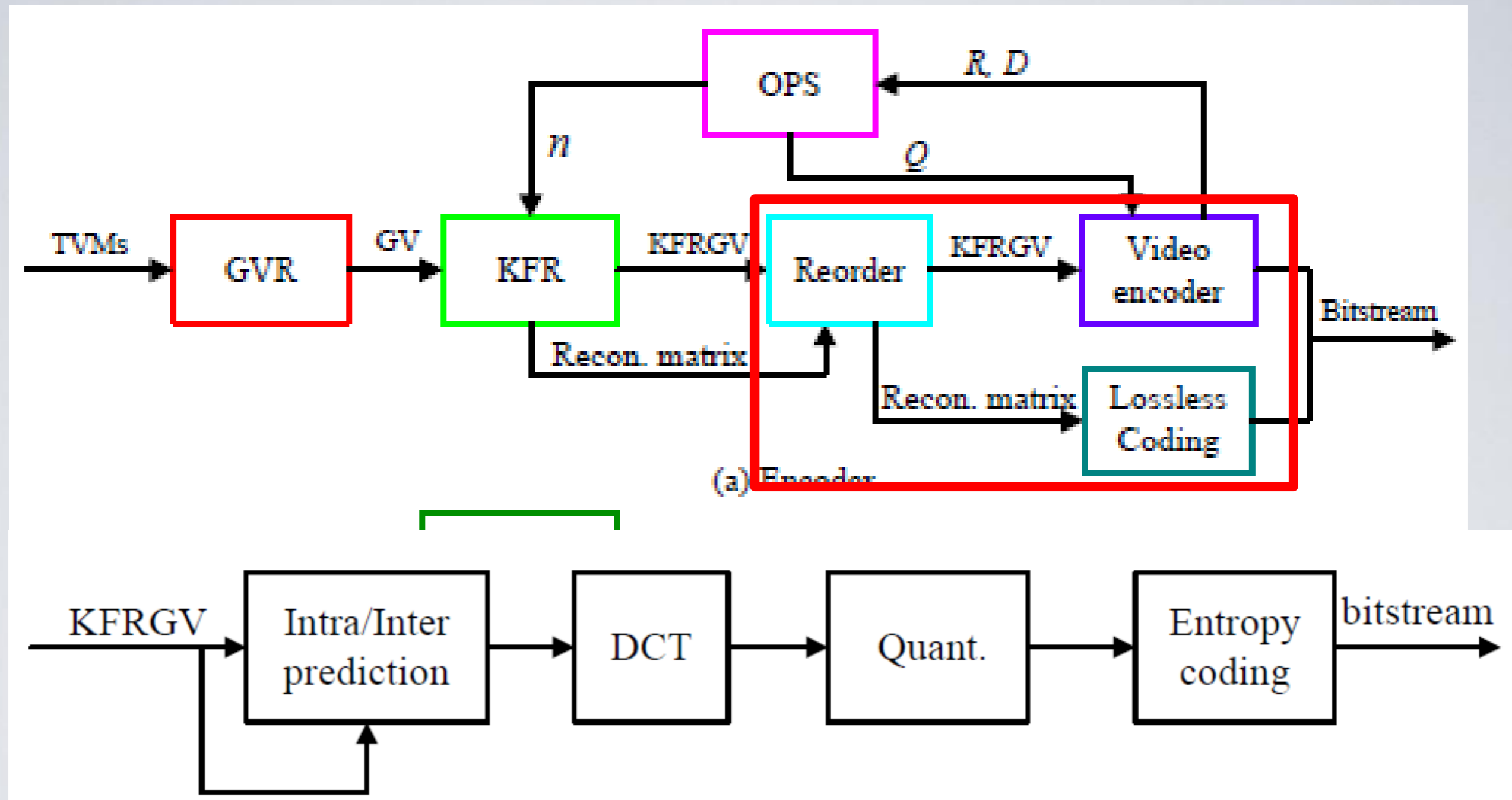
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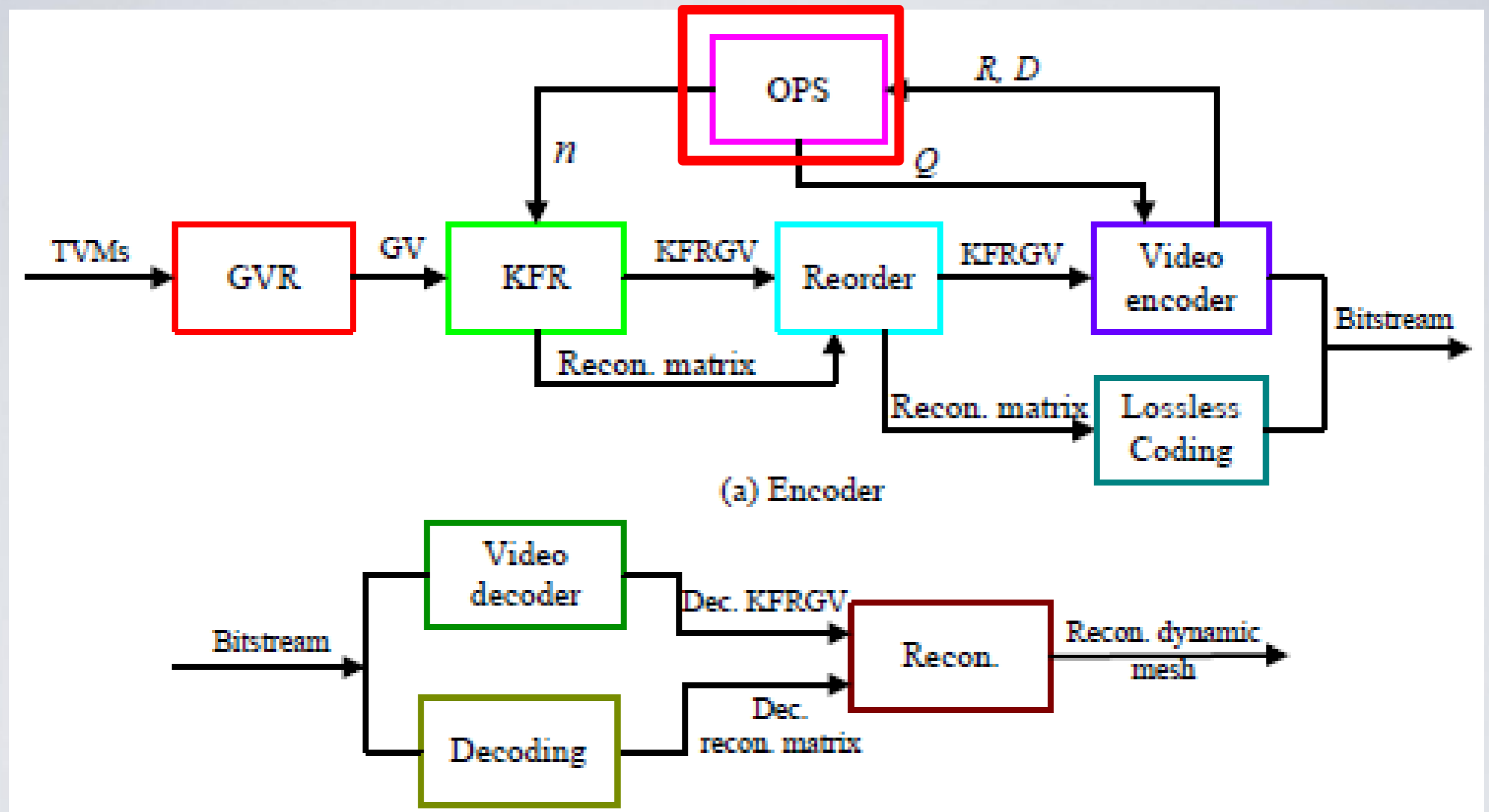
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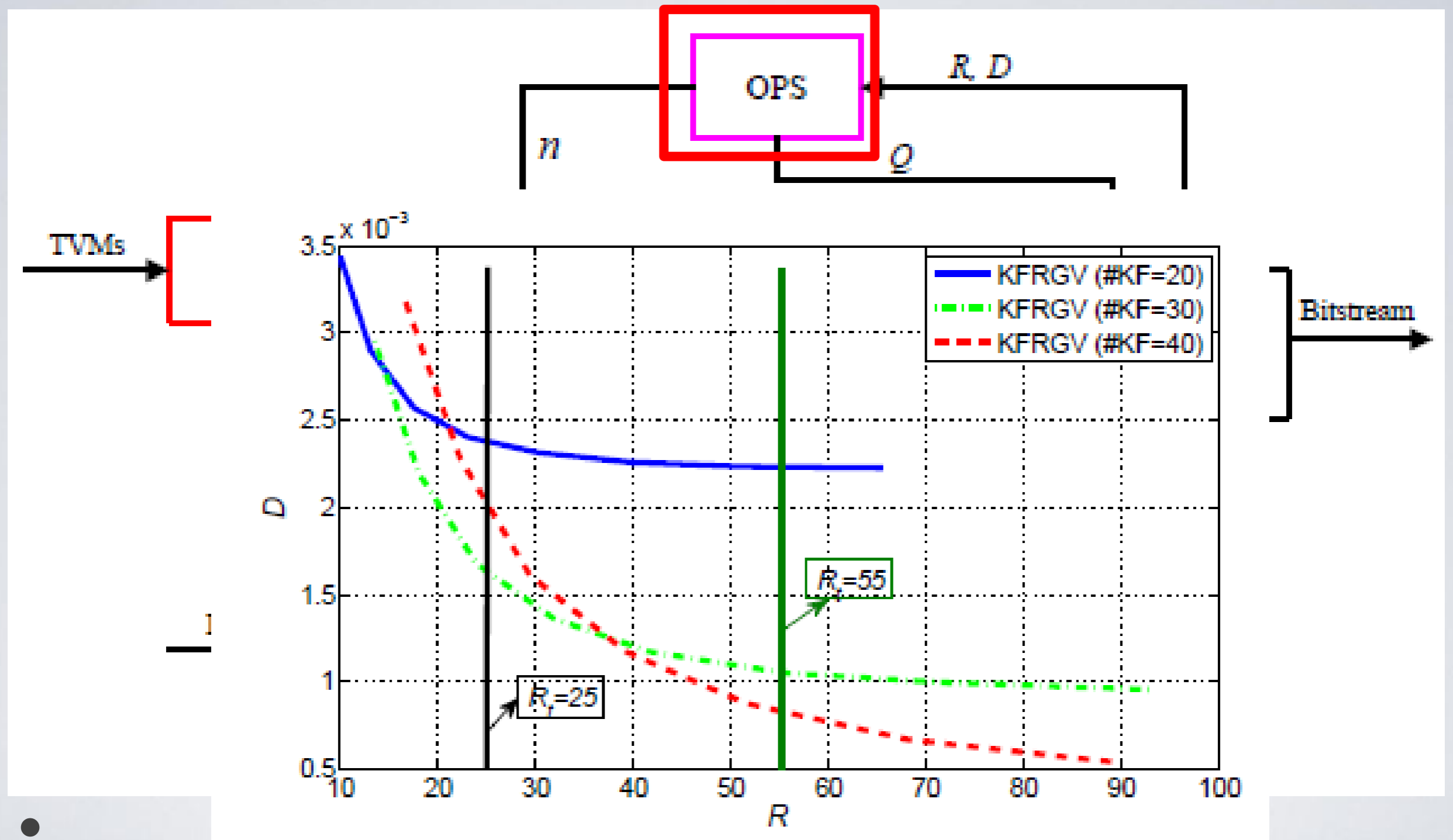
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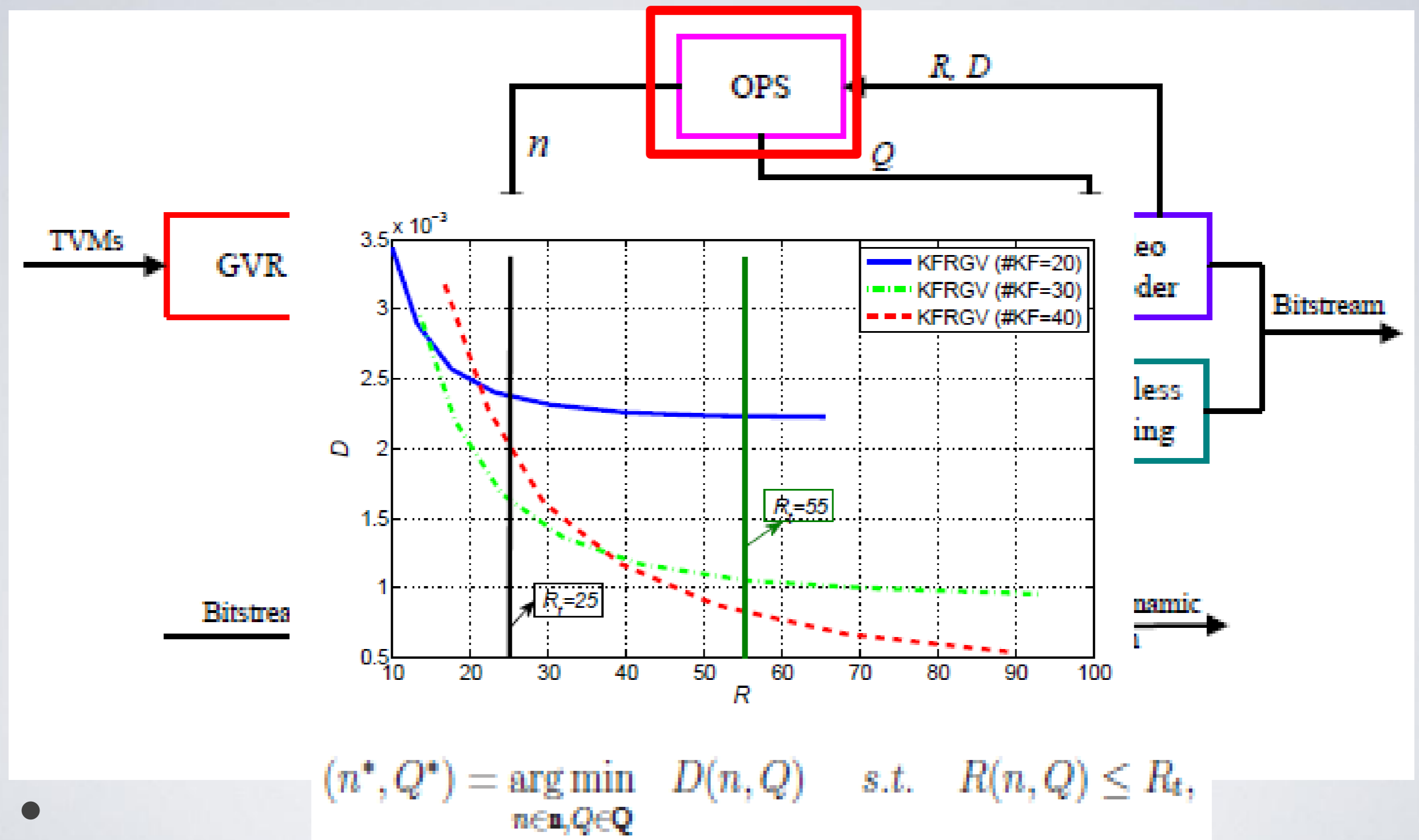
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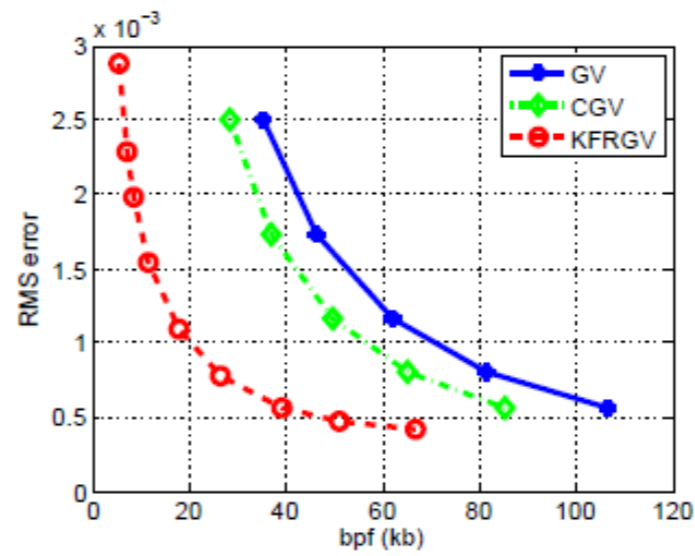


# Experimental results

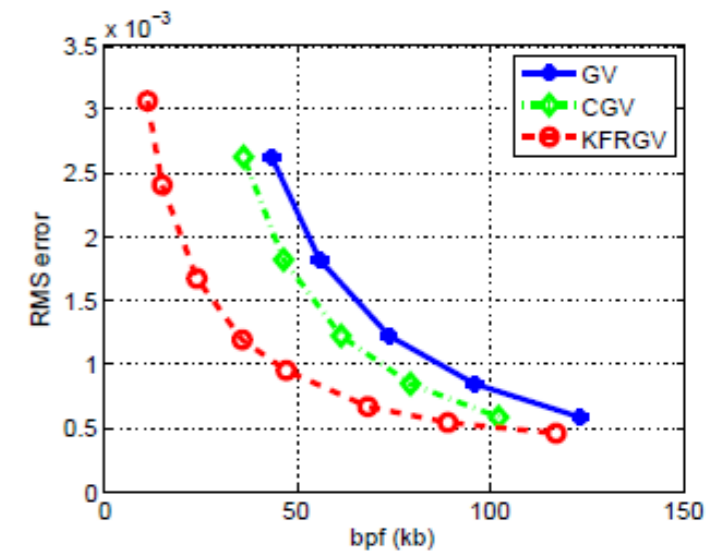
## --R-D performance

- bpf: bit per frame.
- RMS error: root mean square error.

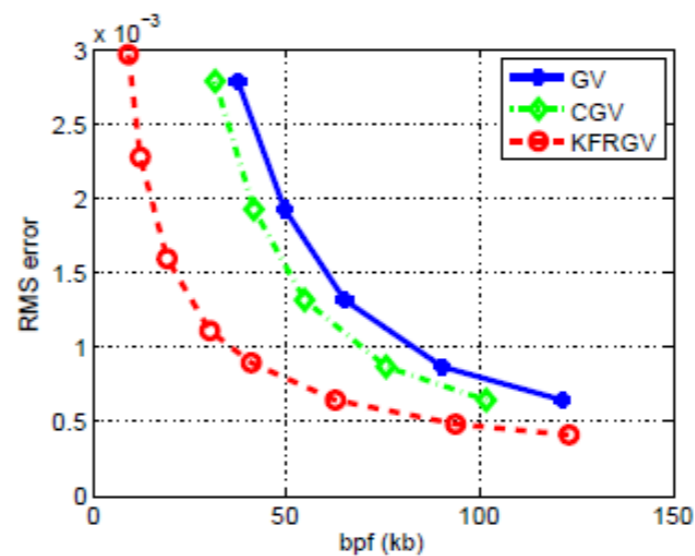
## -- Visual results:



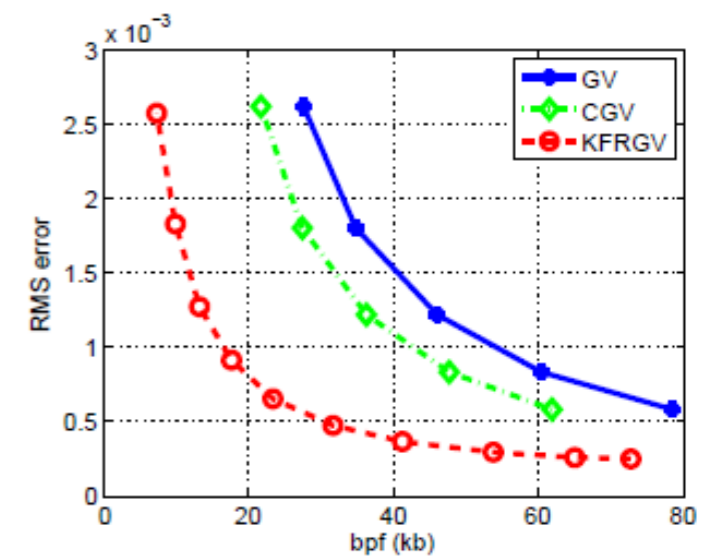
(a)



(b)

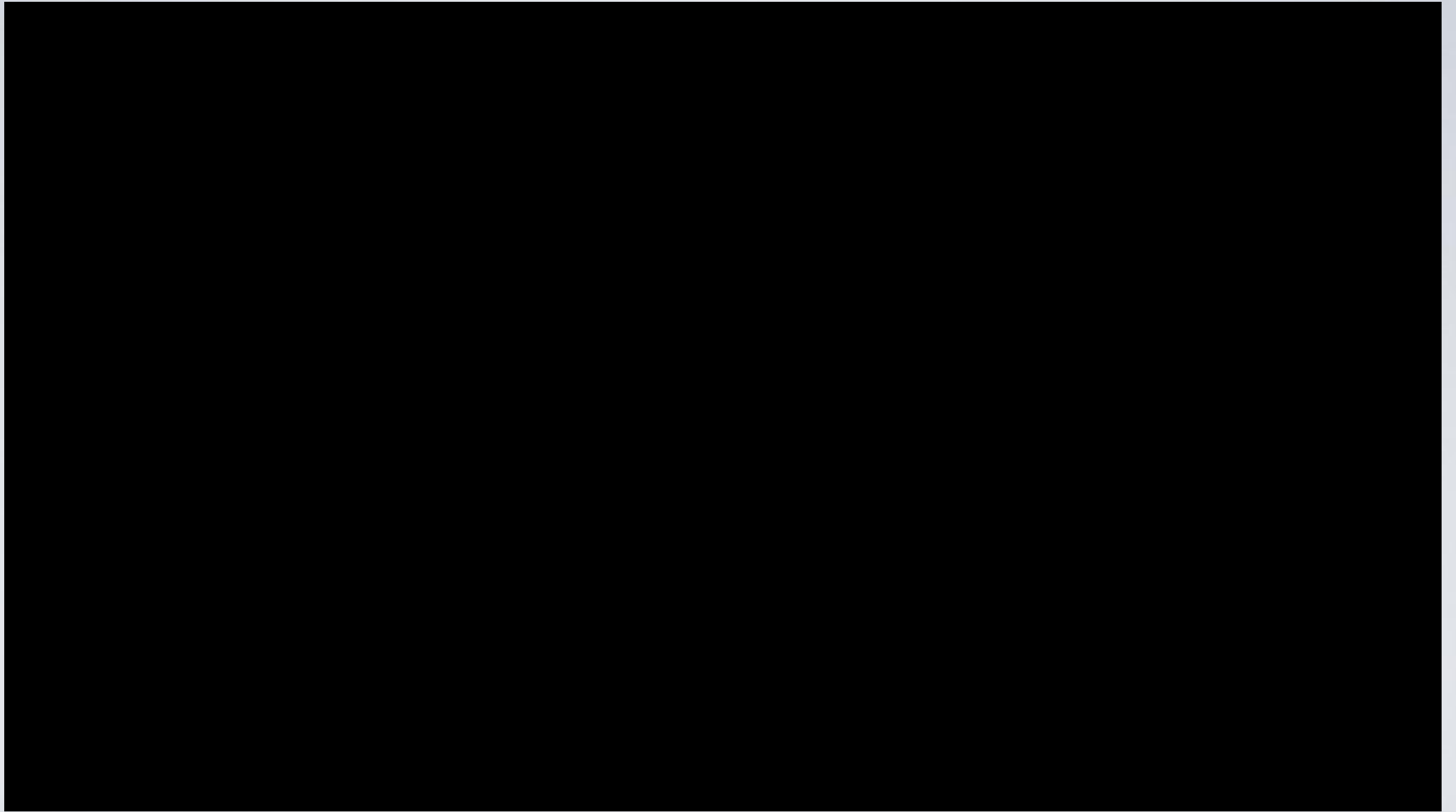


(c)



(d)

# Experimental results



# Conclusion

A novel framework for compressing 3-D TVMs has been presented. We experimentally demonstrate that the proposed scheme outperforms existing algorithms to a large extent.

# Thanks

# Q&A