Progressive Densification of 3D Gaussians for High-Fidelity Talking Head Synthesis

Xueping WANG, Xueni GUO, Feihu YAN, Bing LI, Guangzhe ZHAO

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Problems & Ideas

- Problems of conventional stereo matching approaches:
  - Existing approaches tend to overlook the correlation of facial movements between consecutive frames, leading to unnatural video transitions and obvious artifacts in facial dynamic regions
  - Traditional densification strategies for 3D facial models are mostly static, which either fail to generate sufficient facial details or destroy the overall geometric structure of the head.
- Ideas: The facial dynamic regions are enhanced by introducing an optical flow cross-attention mechanism, while the densification threshold is gradually increased through iterations to improve facial details.

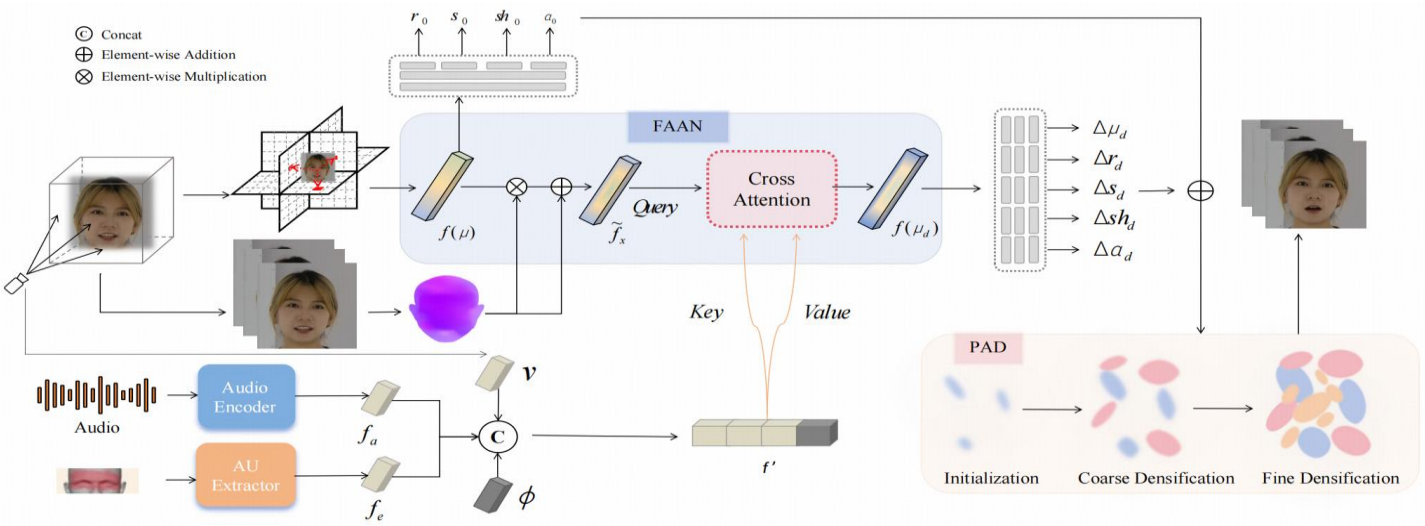

Fig. 1 Architecture overview of PD-GauTalk.

Main Contributions

- Contributions:
  - We propose a Progressive Densification of 3D Gaussians, integrating optical flow into facial point cloud synthesis.
  - Flow Audio Attention Network leverages optical flow to weight facial regions and fuse them with audio features to ensure the continuity of facial movements.
  - Progressive Adaptive Densification strategy dynamically adjusts the distribution of Gaussian points to better preserve facial details.

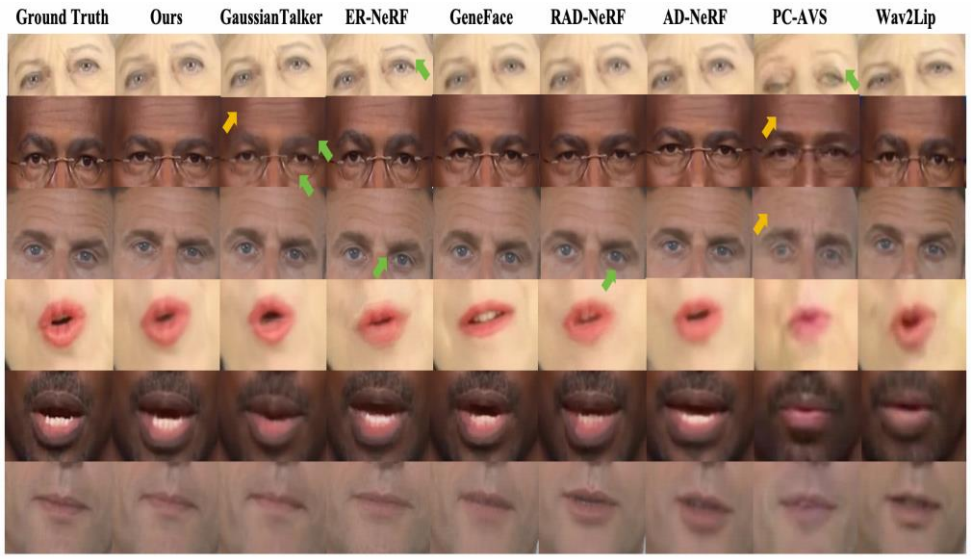

Fig. 2 Comparisons with the SOTA methods.

Method	Year	PSNR↑	LPIPS↓	LMD↓	FID↓	AUE↓	Sync↑	FPS↑
Ground Truth	-	-	-	-	-	-	8.1152	-
Wav2Lip [2]	2020	26.4838	0.1203	3.6693	25.8241	**2.0092**	**8.7667**	15
PC-AVS [10]	2021	21.2529	0.1609	2.8486	34.8909	3.0867	8.1532	31
AD-NeRF [6]	2021	26.4542	0.1366	3.5626	27.8120	3.6379	4.1283	0.1
RAD-NeRF [3]	2022	24.8694	0.1420	3.4637	26.0990	3.1673	4.2380	29
GeneFace [1]	2023	24.7698	0.1345	3.5890	21.6181	3.2706	5.5358	21
ER-NeRF [4]	2023	26.8663	0.0788	3.3046	18.5374	3.0006	5.0942	31
GaussianTalker [7]	2024	30.5324	0.0666	2.8852	6.7775	2.2232	5.7164	**107**
Ours		**30.8629**	**0.0596**	**2.7621**	**6.1249**	2.1319	6.0587	98

Table 1 The quantitative results of the self-driven head setting