Hierarchical Granularity Alignment and State Space Modeling for Robust Multimodal AU Detection in the Wild

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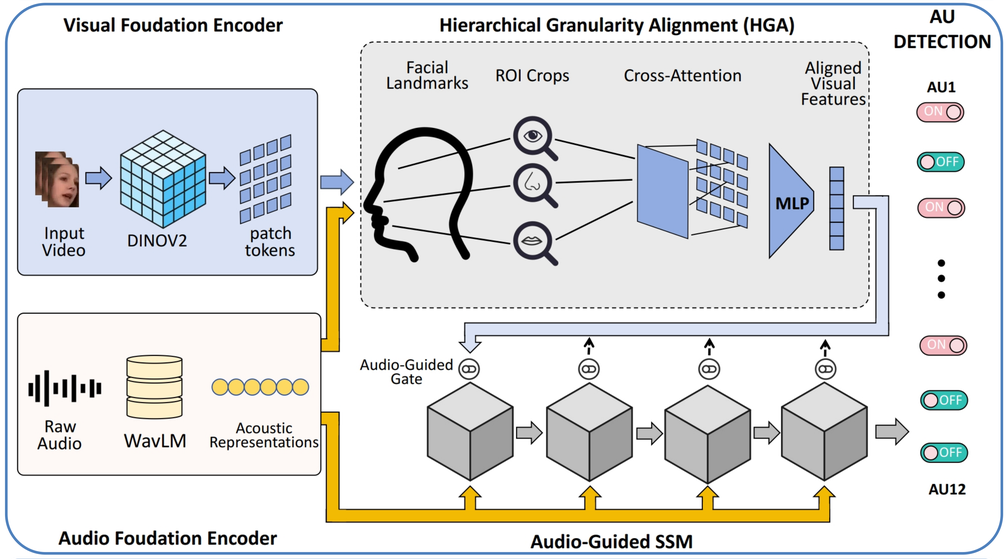
Problem & Motivation:

- Subtle AU activations are easily affected by pose, illumination, and occlusion.
- Local facial muscle movements require fine-grained spatial modeling.
- Long videos require efficient long-range temporal reasoning.
- Audio and visual cues are correlated but often fused shallowly.

Main Contributions:

- We use DINOv2 and WavLM to extract robust visual and audio representations.
- We propose Hierarchical Granularity Alignment (HGA) to align local AU regions with global facial context.
- We introduce Audio-Guided SSM (AG-SSM) for efficient long-range audio-visual temporal modeling.

Overall Framework



Method Details

Hierarchical Granularity Alignment:

- Facial landmarks define AU-related local regions.
- Local RoI features query global DINOv2 patch tokens.
- Cross-attention aligns local muscle activations with global facial semantics.

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Ablation Results on Validation Set:

Architecture Setup	FM	HGA	AG-SSM	ASL	F1 Score (%)
Baseline					36.50
+ Foundation Models	✓				52.41
+ HGA Module	✓	✓			55.18
+ AG-SSM Temporal Modeling	✓	✓	✓		57.82
Full Framework (+ ASL)	✓	✓	✓	✓	**59.45**

Key findings :

- Foundation models provide the largest performance gain.
- HGA improves robustness to local facial variations.
- AG-SSM improves temporal modeling for long in-the-wild videos.

Conclusion :

We present a multimodal AU detection framework combining foundation models, hierarchical spatial alignment, and audio-guided state space modeling. The method achieves 59.45% F1 on Aff-Wild2 validation and ranks 1st in the ABAW10 AU Detection Track.