Long-Distance Gesture Recognition using Dynamic Neural Networks

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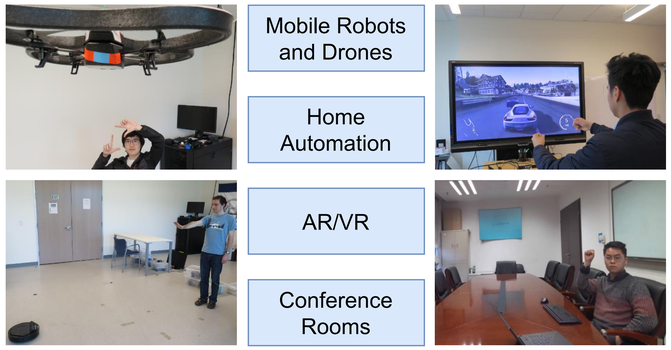
Motivation



- Gestures are a natural interface for communication between humans and machines
- Provide a convenient and contact-less way to communicate with robots

Challenges in Long Distance Recognition

Gesturing subject is small **&** 3D CNNs down sample input

Features might lose too much gesture information

Higher resolution video requires more compute, bandwidth!

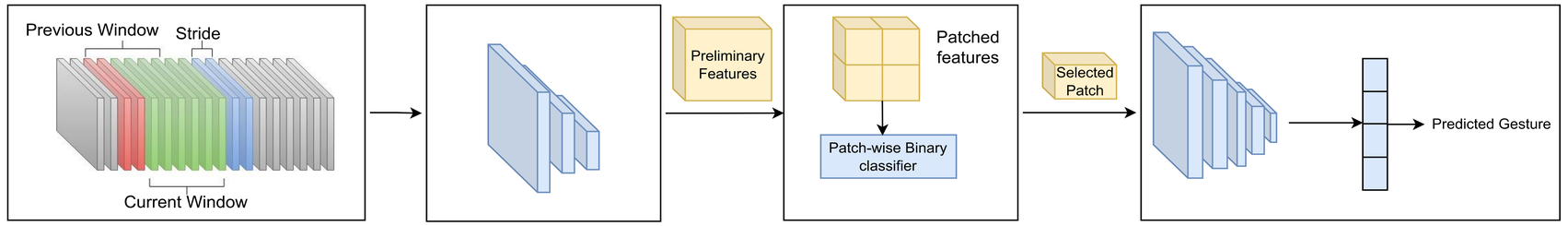
Use Spatially Dynamic Neural networks

Can adapt computational graph to input at run-time

Discard background features

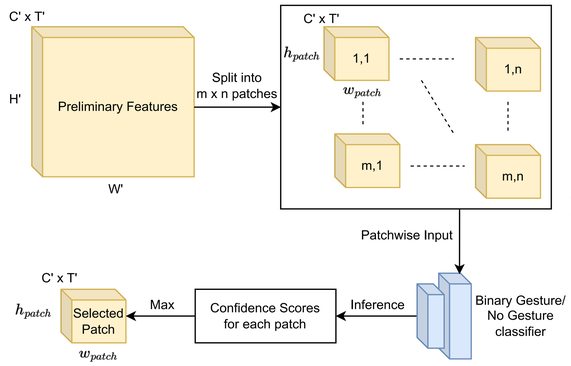
Preserve gesturing subject features

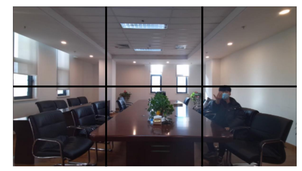
Proposed Spatially Dynamic Neural Network



Binary Gesture Classifier

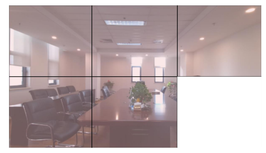
- Core of Patch selection subnetwork
- Predicts if input patch features contain subject
- Trained using rough subject location annotations





Selected Patch

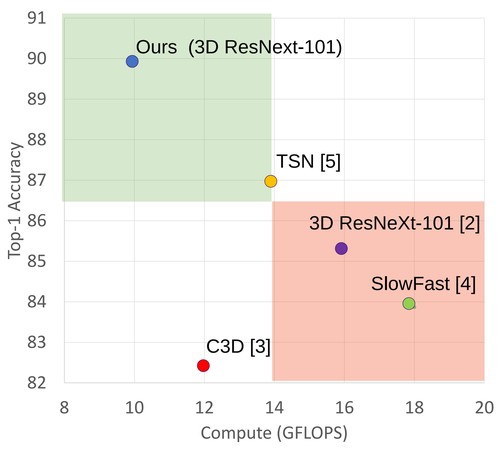
Discarded Patches



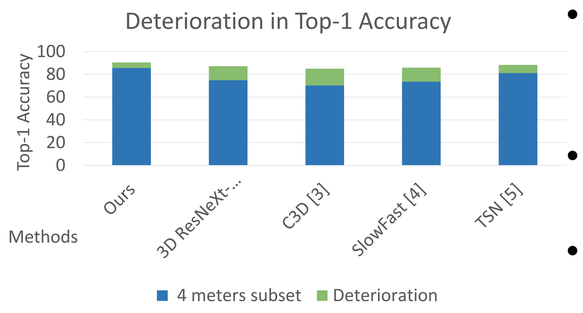
Training Loss

$L = L_{h_\phi} + \lambda L_{g_\psi}$ L_{h_ϕ} = Cross entropy for Gesture Recognition L_{g_ψ} = Cross entropy for Patch Selection

Experimental Results



Method	Compute (GFLOPS)	Top-1 Accuracy
Ours (3D MobileNet)	1.5	**76.68**
3D MobileNet [6]	1.5	65.33



Num of patches (m x n)	Compute (GFLOPS)	Accuracy %
1 x 2	26	86.48
2 x 2	18	88.67
2 x 3	**10**	**89.94**

- **Lower compute & Better performance** compared to state-of-the-art
- **Lower** performance deterioration with distance
- **Smaller** patches improve accuracy, efficiency

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