ID 25: Benchmarking Reliability of Deep Learning Models for Pathological Gait Classification

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Routine Walking

- Gait disorders increase from 10% to **more than 60% in the elderly between the ages of 60 and 80**.
- Gait abnormalities severely affect the Quality of Life (QoF).
- Altered gait could represent a lingering neurodegenerative condition.

Geriatric Gait - At home Needs

- Regular hospital commutes difficult in remote areas.
- **Early diagnosis requires detection in home settings**.
- Vision based detection is suitable for home settings.

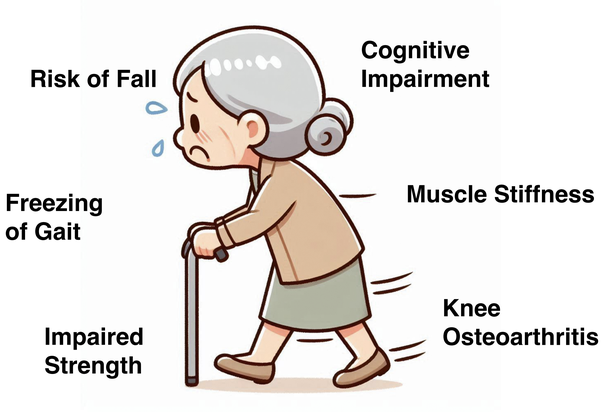

Figure 1:Elderly Gait

Existing Space of Work

- Spatio-Temporal Graph Convolutional Networks (STGCN) are well suited to model human pose
- Many existing models are tested only on a single gait dataset

Benchmarking Study

- Previous evaluations often lack proper validation
- Over-parameterized models like STGCN tend to overfit gait data

Proposed Method

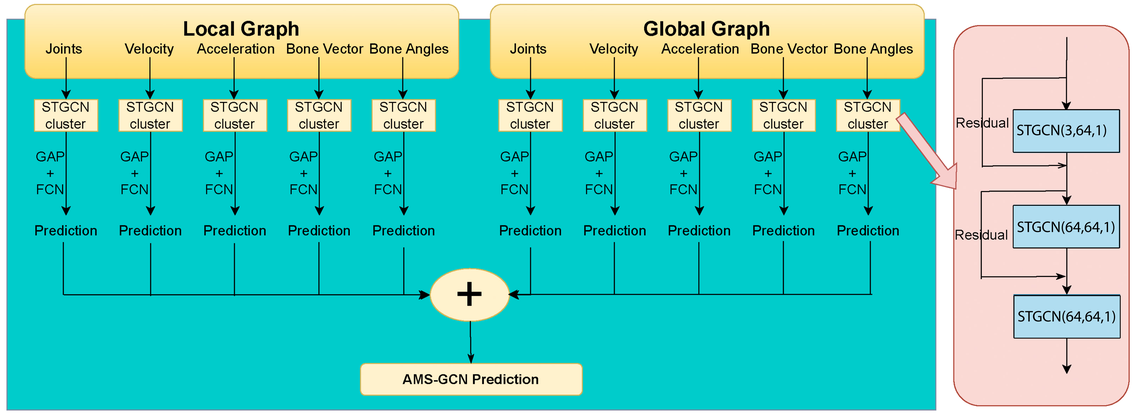

Figure 2:AMSGCN Model

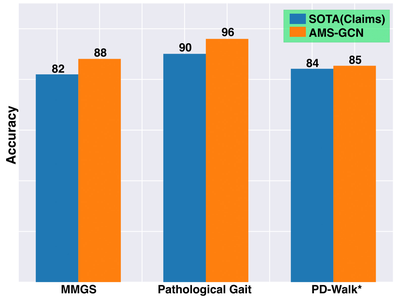

Figure 3:AMSGCN Results

AMSGCN

We present a robust baseline to ensure stable performance on multiple datasets.

- Multi-Stream STGCN network that incorporates global and local joint connection branches
- Consistent validation and test scores across multiple dataset

Table 1:AMS-GCN Input feature comparison - best and worst feature combinations and respective F1 scores.

	Method Worst F1	best F1
	Multi-Modal Gait Symmetry Dataset	
1	Acc(56.0)	**boneA(86.0)**
2	Vel+Acc(55.0)	boneL+boneA(87.0)
3	Joint+Vel+Acc(77.0)	Acc+boneL+boneA(87.0)
4	Joint+vel+Acc+boneL(82.0)	**Joint+Acc+boneL+boneA(86.0)**
	PD-Walk Dataset	
1	Acc(17.0)	**boneL(87.0)**
2	Vel+Acc(17.0)	boneL+boneA(86.0)
3	Vel+Acc+boneA(83.0)	Acc+boneL+boneA(86.0)
4	Joint+Vel+Acc+boneA(85.0)	**Vel+Acc+boneL+boneA(86.0)**
	Walking Gait Dataset	
1	Joint(41.0)	Acc(62.0)
2	Vel+Acc(54.0)	Joint+Acc(66.0)
3	Joint+boneL+boneA(55.0)	Vel+Acc+boneA(71.0)
4	Joint+Vel+Acc+boneL(63.0)	**Joint+Acc+boneL+boneA(64.0)**

Performance Insights

Is any one feature more important?

- Weighted feature combination did not provide consistent improvement
- Different individual features shine for different datasets but using more features tapers this gap
- Direct combination performance improvement was visible even with reduced inputs

What Next

Clinical viewpoint on the proposed results
Collaborations and Postdoc?

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