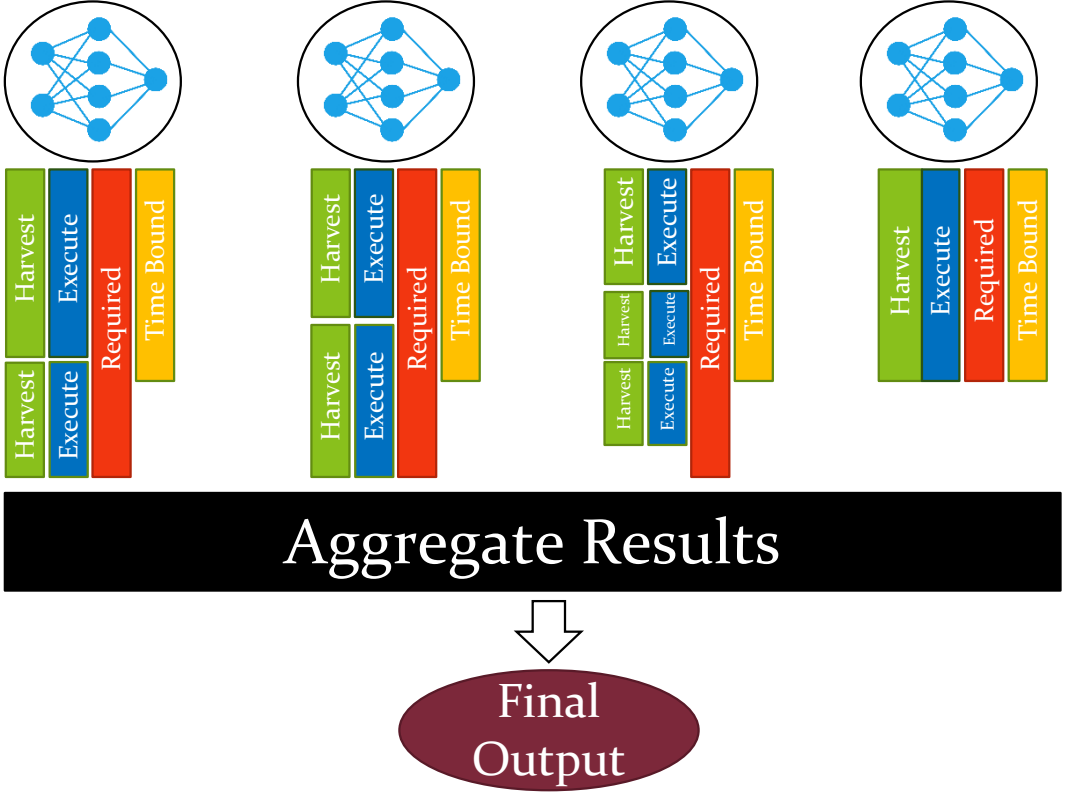
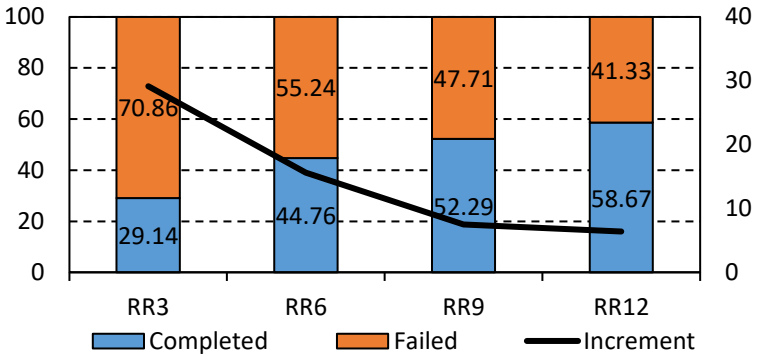
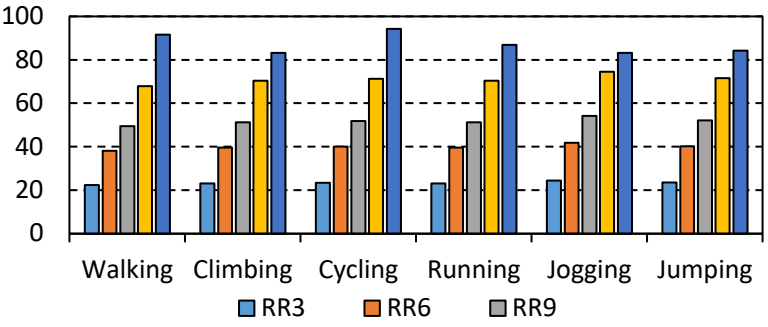
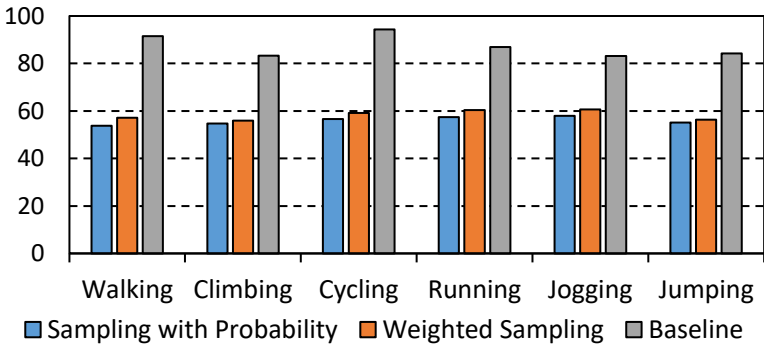
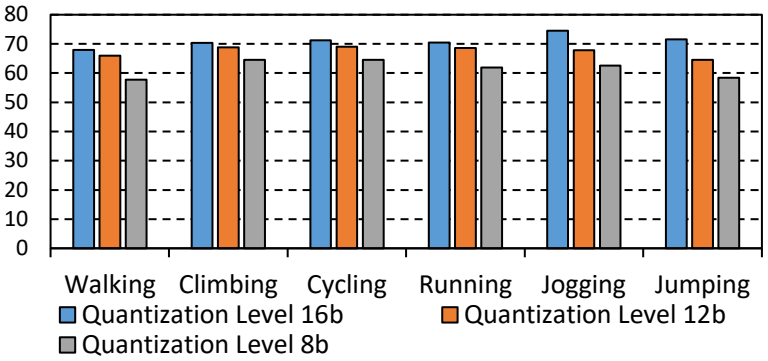
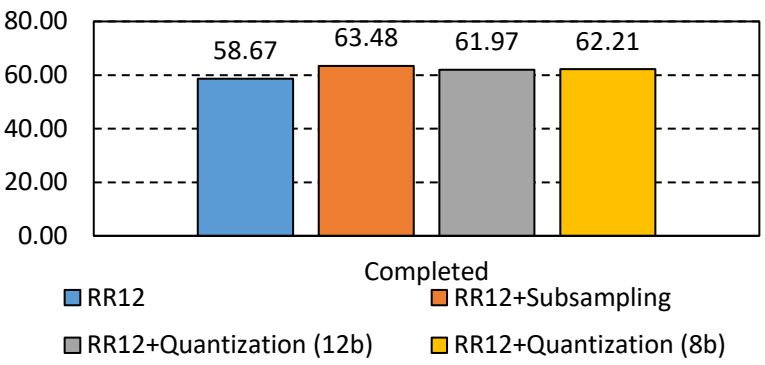

Harvest
Execute
Required
Time Bound
Harvest
Execute
Harvest
Execute
Required
Time Bound
Harvest
Execute
Harvest
Execute
Harvest
Execute
Required
Time Bound
Harvest
Execute
Required
Time Bound
Aggregate Results
Final Output

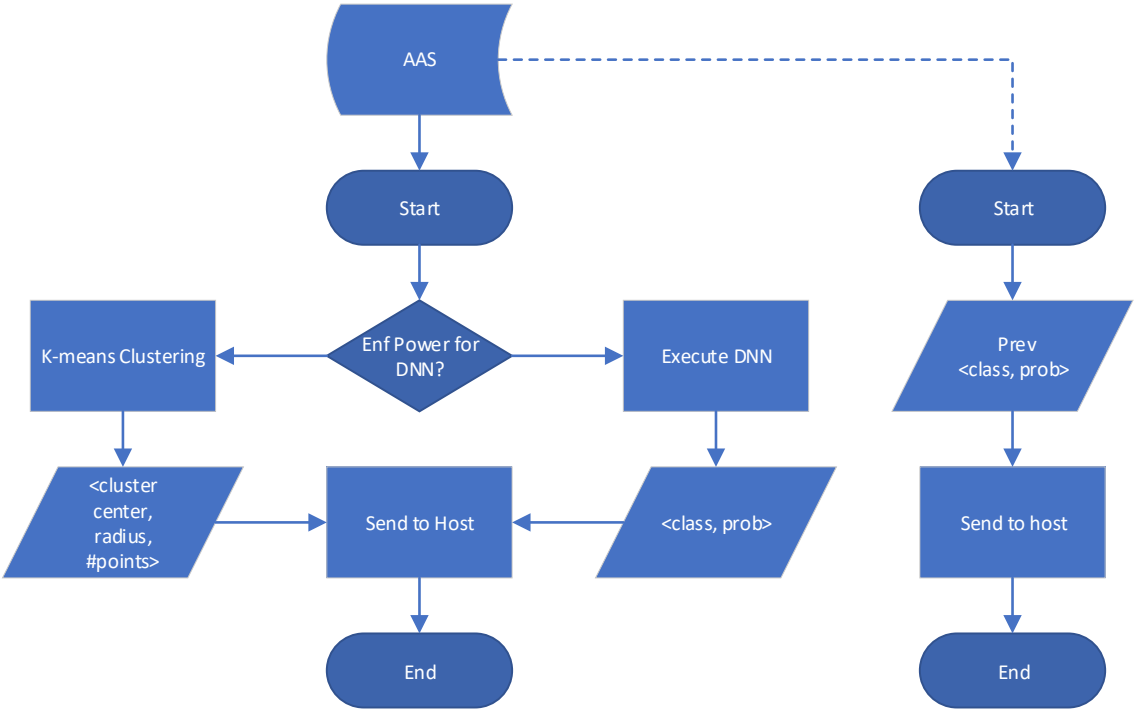

100
80
60
40
20
0
40
30
20
10
0
70.86
55.24
47.71
41.33
29.14
44.76
52.29
58.67
RR3
RR6
RR9
RR12
Completed
Failed
Increment

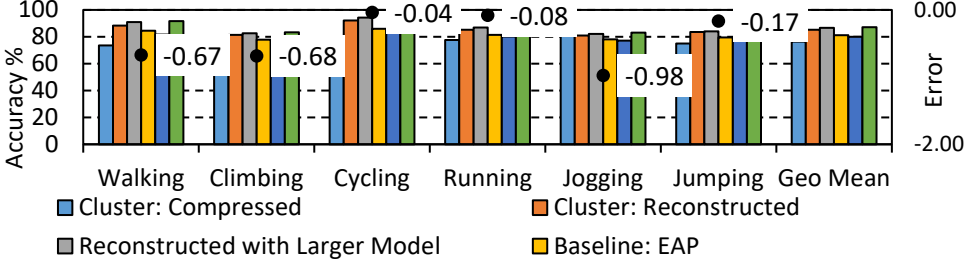

100
80
60
40
20
0
Walking
Climbing
Cycling
Running
Jogging
Jumping
RR3
RR6
RR9

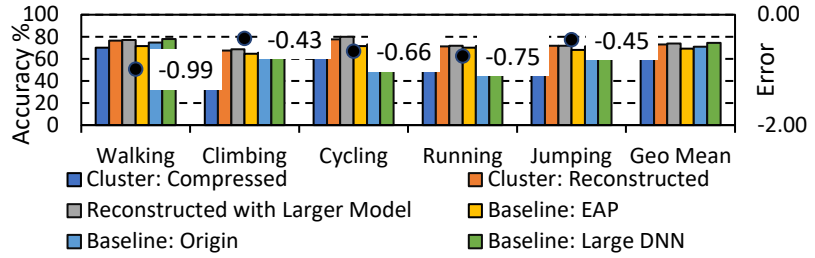

100
80
60
40
20
0
Walking
Climbing
Cycling
Running
Jogging
Jumping
Sampling with Probability
Weighted Sampling
Baseline

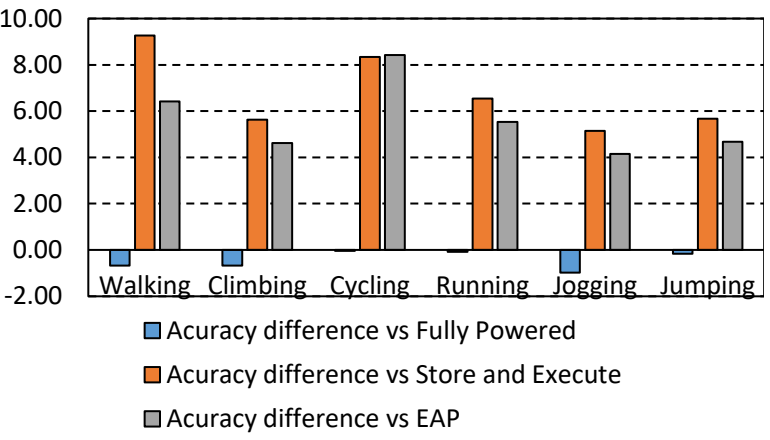

80
70
60
50
40
30
20
10
0
Walking
Climbing
Cycling
Running
Jogging
Jumping
Quantization Level 16b
Quantization Level 12b
Quantization Level 8b

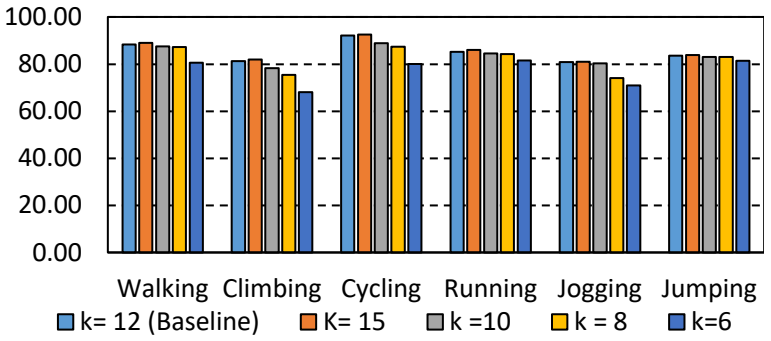

80.00
60.00
40.00
20.00
0.00
58.67
63.48
61.97
62.21
Completed
RR12
RR12+Subsampling
RR12+Quantization (12b)
RR12+Quantization (8b)

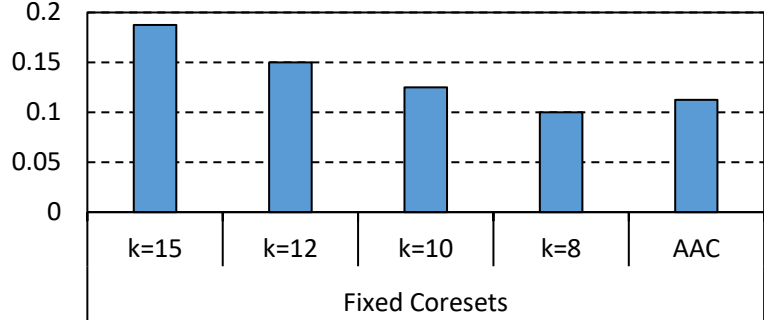

AAS
Start
Start
Enf Power for DNN?
K-means Clustering
Execute DNN
Prev <class, prob>
<cluster center, radius, #points>
Send to Host
<class, prob>
Send to host
End
End

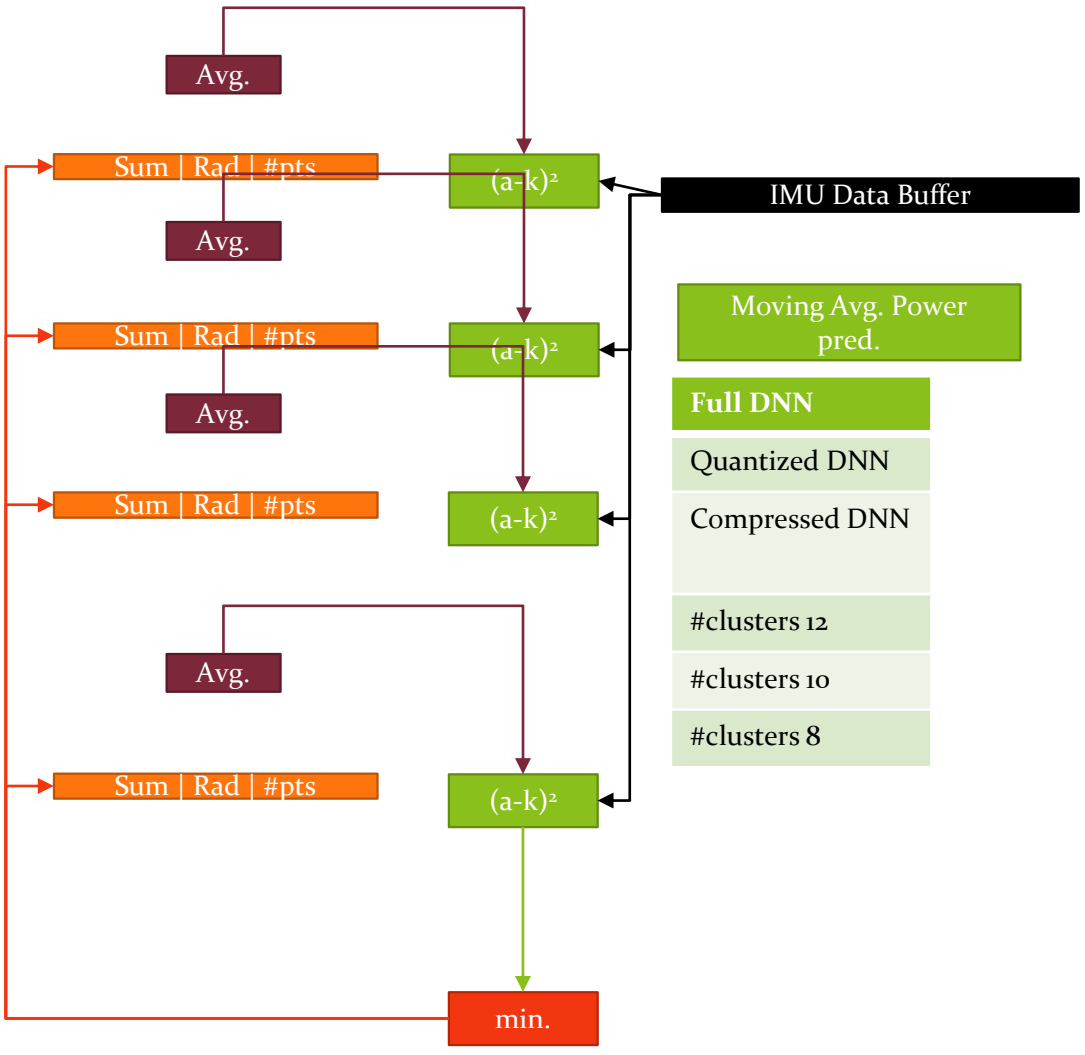

100
80
60
40
20
0
Accuracy %
0.00
-2.00
Error
-0.67
-0.68
-0.04
-0.08
-0.98
-0.17
Walking
Climbing
Cycling
Running
Jogging
Jumping
Geo Mean
Cluster: Compressed
Cluster: Reconstructed
Reconstructed with Larger Model
Baseline: EAP

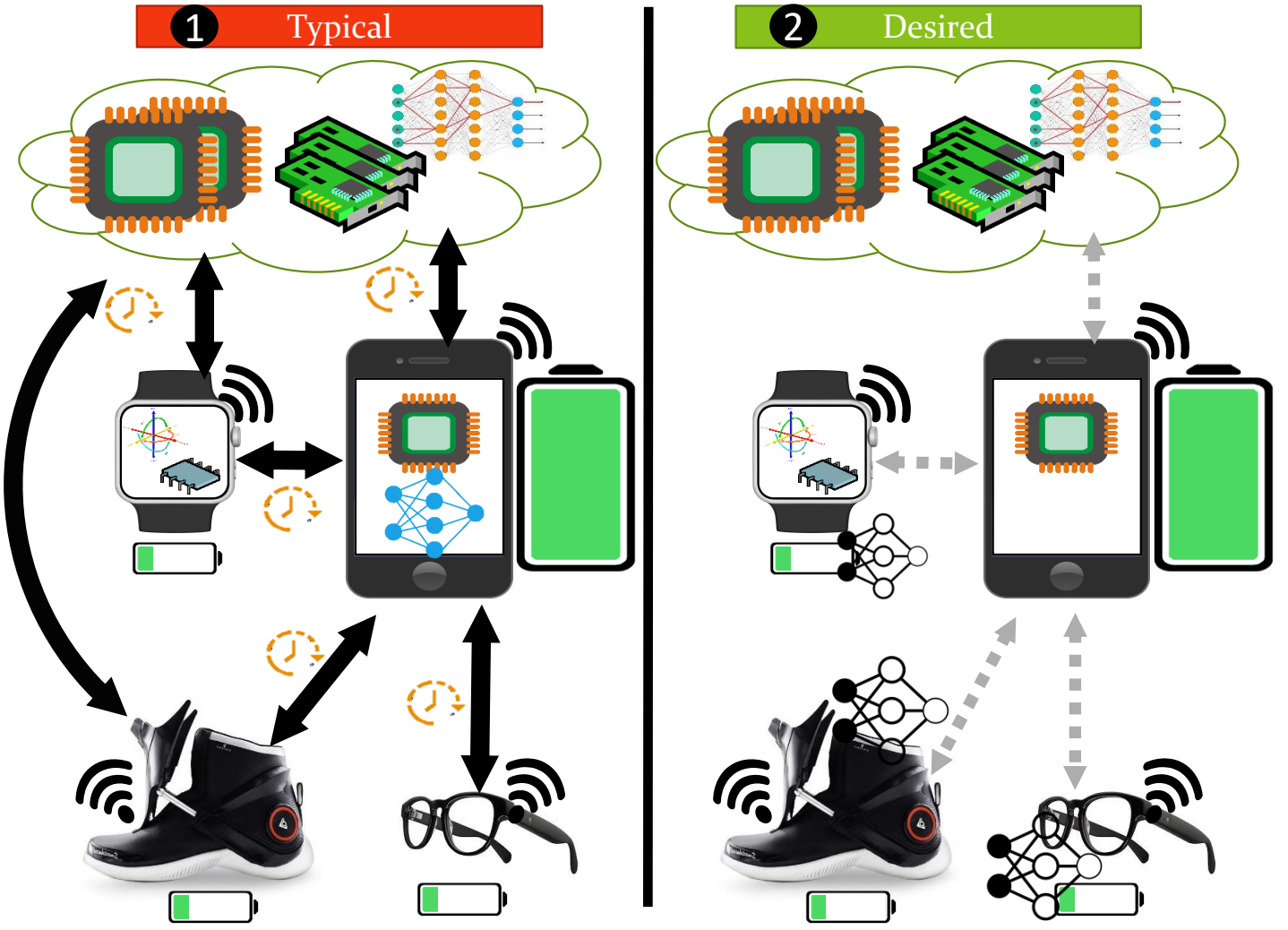

100
80
60
40
20
0
Accuracy %
0.00
-2.00
Error
-0.99
-0.43
-0.66
-0.75
-0.45
Walking
Climbing
Cycling
Running
Jumping
Geo Mean
Cluster: Compressed
Cluster: Reconstructed
Reconstructed with Larger Model
Baseline: EAP
Baseline: Origin
Baseline: Large DNN

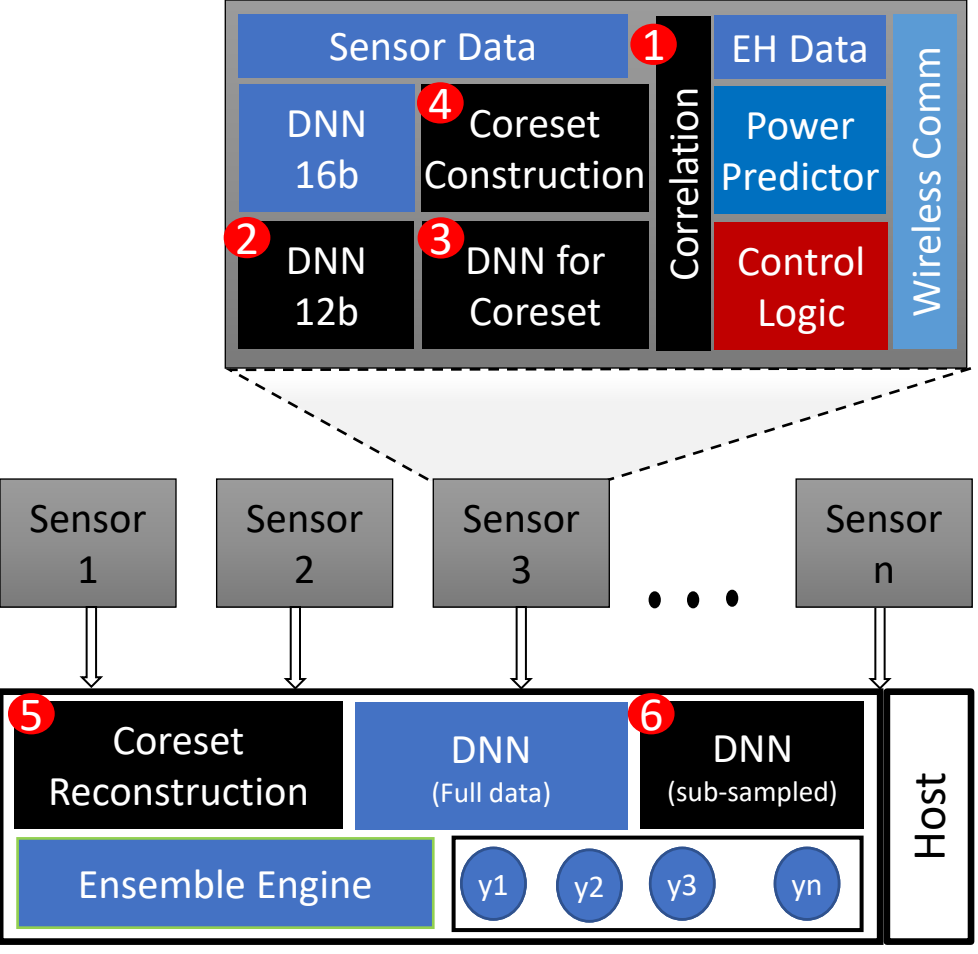

10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Walking
Climbing
Cycling
Running
Jogging
Jumping
Acuracy difference vs Fully Powered
Acuracy difference vs Store and Execute
Acuracy difference vs EAP

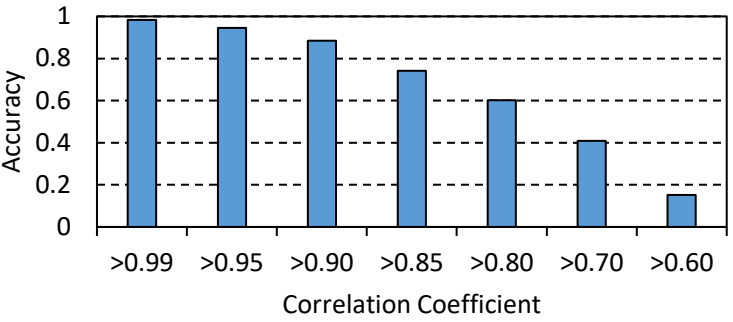

100.00
80.00
60.00
40.00
20.00
0.00
Walking
Climbing
Cycling
Running
Jogging
Jumping
k= 12 (Baseline)
K= 15
k =10
k = 8
k=6

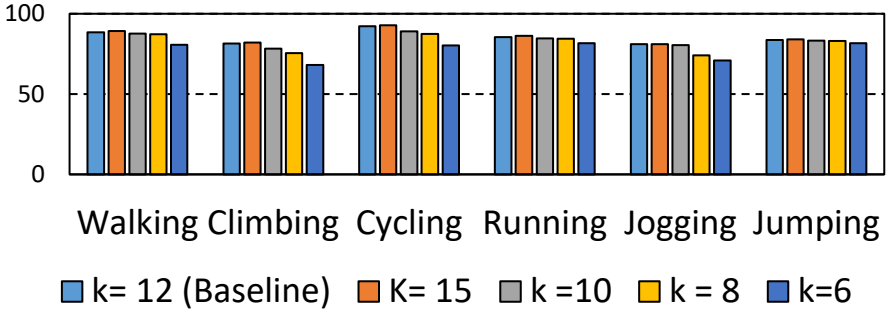

0.2
0.15
0.1
0.05
0
k=15
k=12
k=10
k=8
AAC
Fixed Coresets

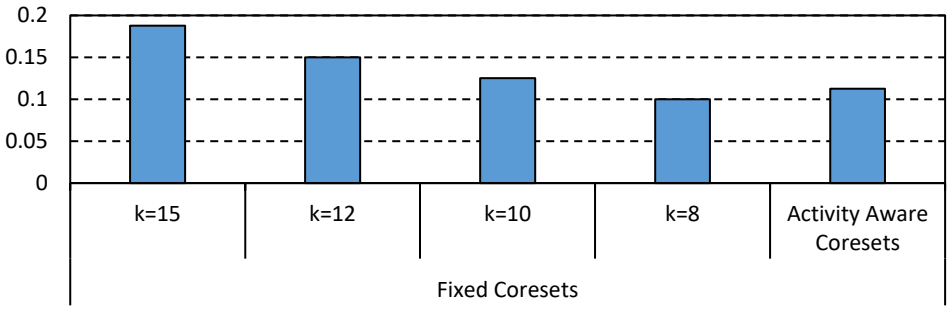

Avg.
Sum | Rad | #pts
(a-k)²
IMU Data Buffer
Avg.
Sum | Rad | #pts
(a-k)²
Avg.
Sum | Rad | #pts
(a-k)²
Avg.
Sum | Rad | #pts
(a-k)²
min.
Moving Avg. Power pred.
Full DNN
Quantized DNN
Compressed DNN
#clusters 12
#clusters 10
#clusters 8

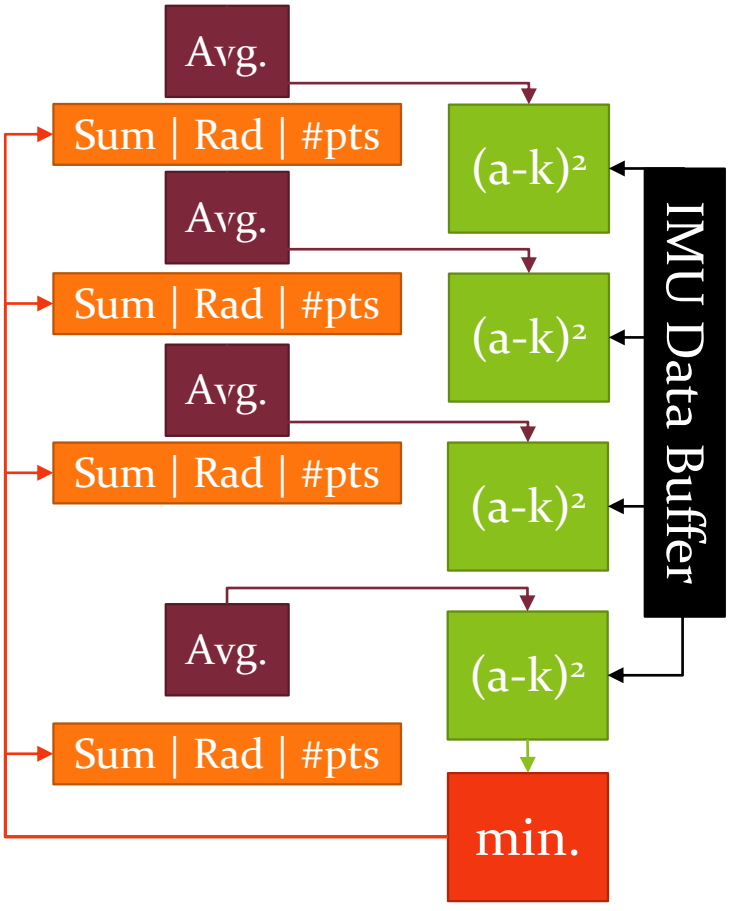

1
Typical
2
Desired


Sensor Data
1
EH Data
DNN 16b
4
Coreset Construction
Correlation
Power Predictor
Wireless Comm
2
DNN 12b
3
DNN for Coreset
Control Logic
Sensor 1
Sensor 2
Sensor 3
Sensor n
5
Coreset Reconstruction
DNN (Full data)
6
DNN (sub-sampled)
Host
Ensemble Engine
y1
y2
y3
yn


1
0.8
0.6
0.4
0.2
0
Accuracy
>0.99
>0.95
>0.90
>0.85
>0.80
>0.70
>0.60
Correlation Coefficient


100
50
0
Walking
Climbing
Cycling
Running
Jogging
Jumping
k= 12 (Baseline)
K= 15
k =10
k = 8
k=6


0.2
0.15
0.1
0.05
0
k=15
k=12
k=10
k=8
Activity Aware Coresets
Fixed Coresets


Avg.
Sum | Rad | #pts
(a-k)²
Avg.
Sum | Rad | #pts
(a-k)²
Avg.
Sum | Rad | #pts
(a-k)²
Avg.
Sum | Rad | #pts
(a-k)²
IMU Data Buffer
min.