

Characterizing Electrocardiogram Signals using Capsule Networks

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Learning Meaningful Representations of Life Workshop

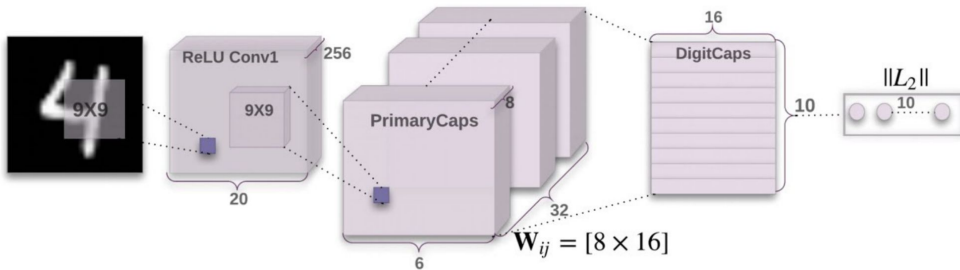
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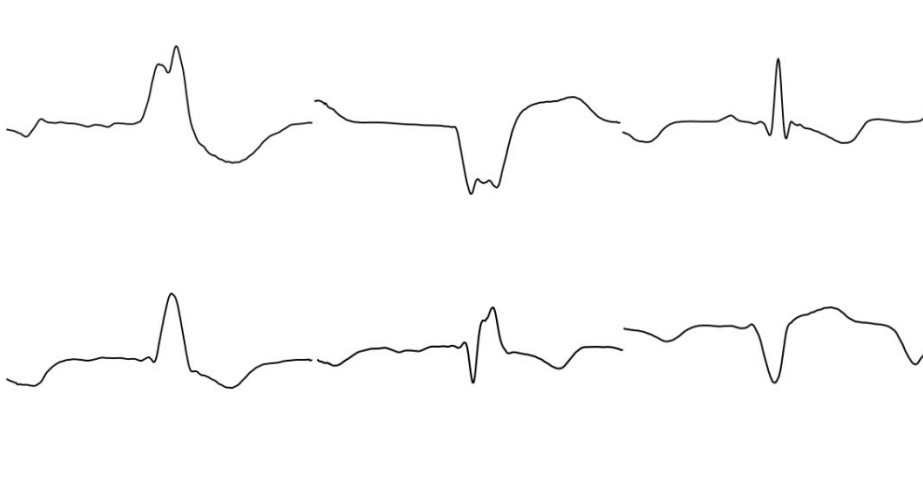


2D Capsule Neural Networks



[1] S. Sabour, N. Frosst, and G. E. Hinton, "Dynamic routing between capsules," in *NIPS*, Long Beach, CA, 2017

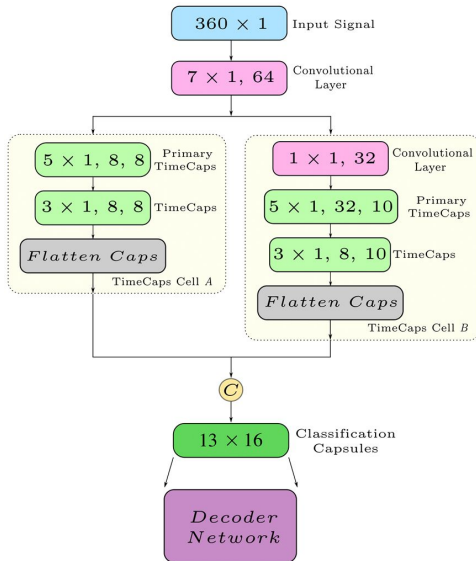
Motivation



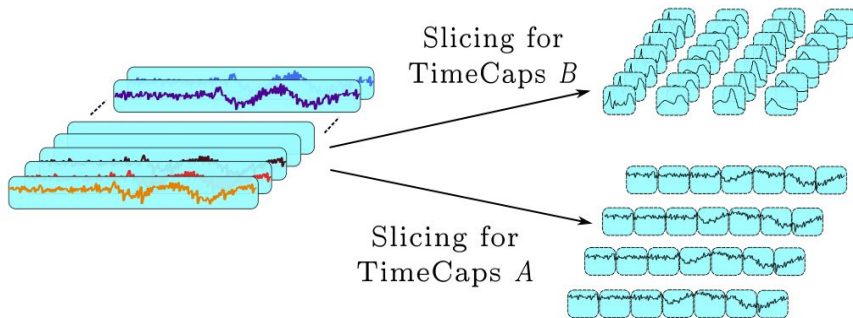
Contribution

We propose TimeCaps, which can simultaneously perform characterisation, classification, decomposition, compression and reconstruction on 1D signals.

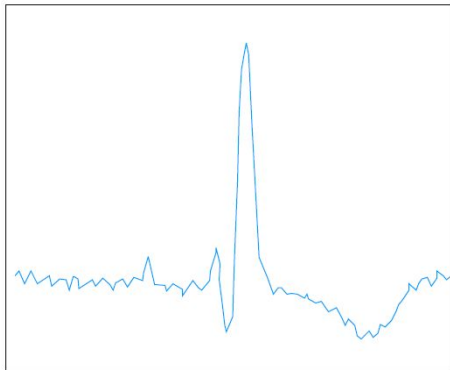
Proposed Time Capsule Networks



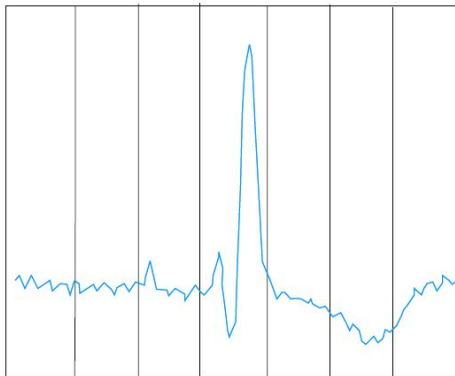
Signal Slicing



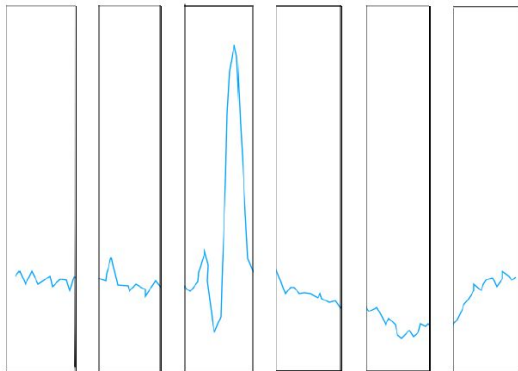
TimeCaps A



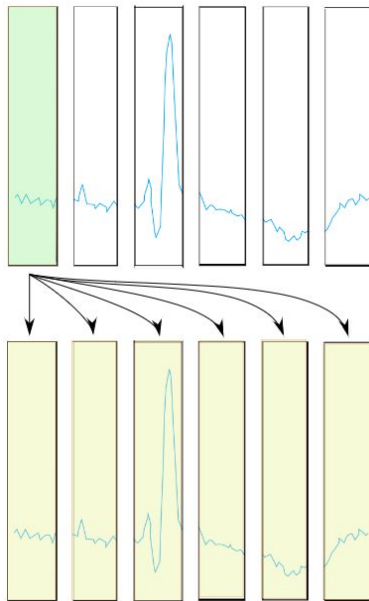
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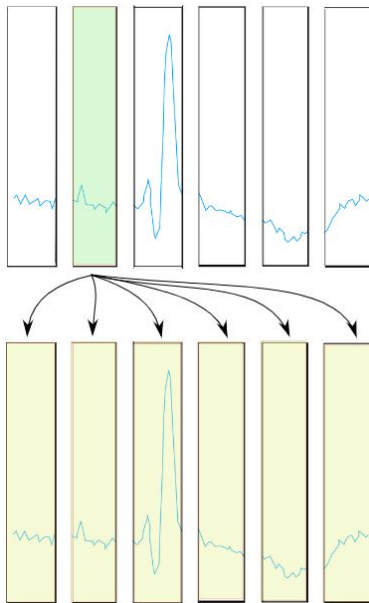
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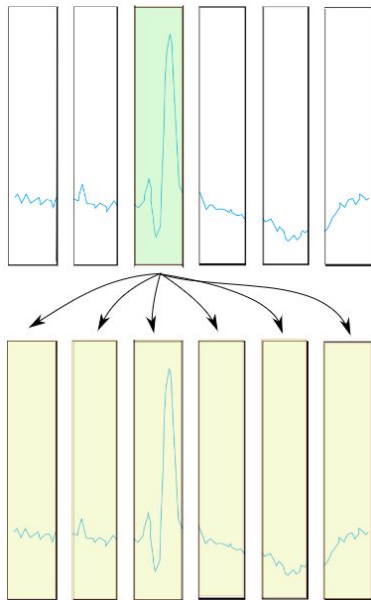
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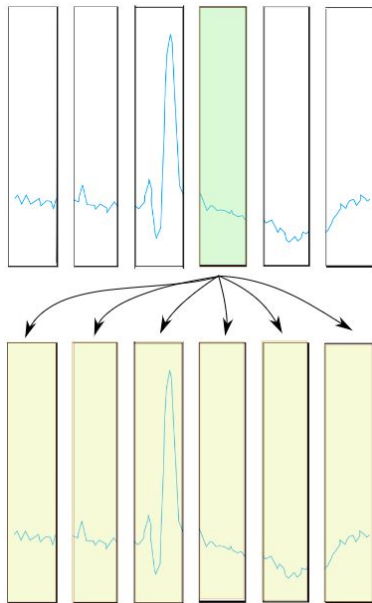
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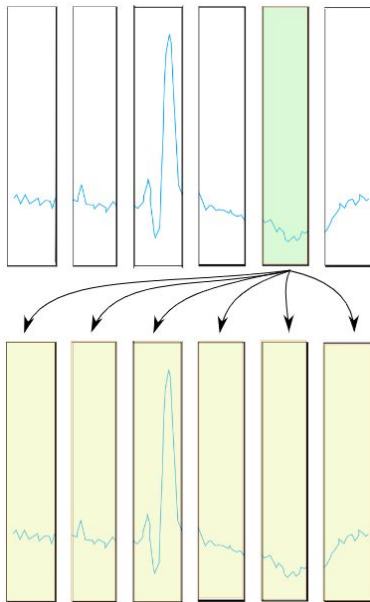
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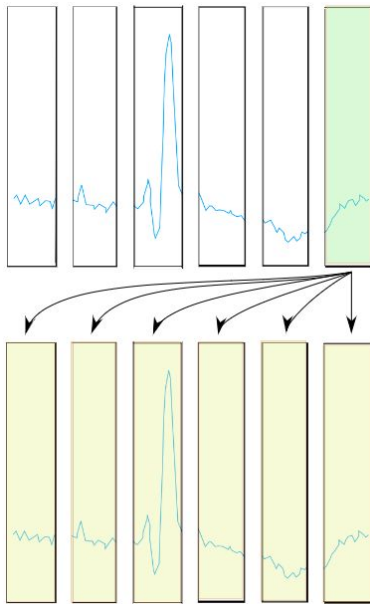
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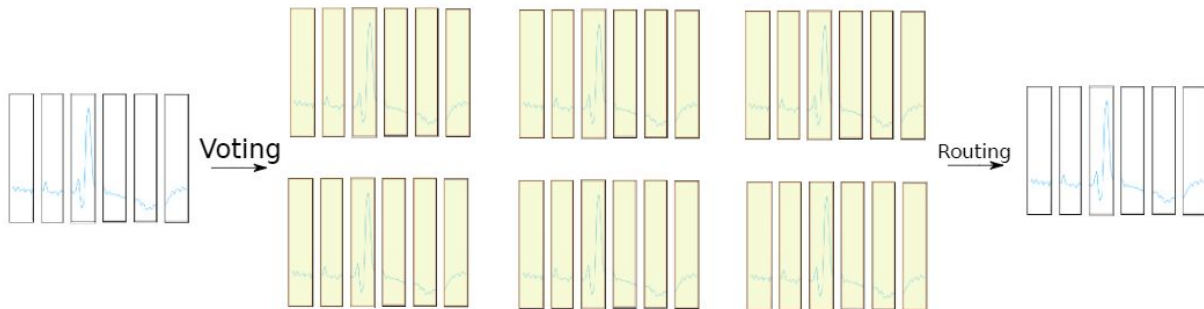
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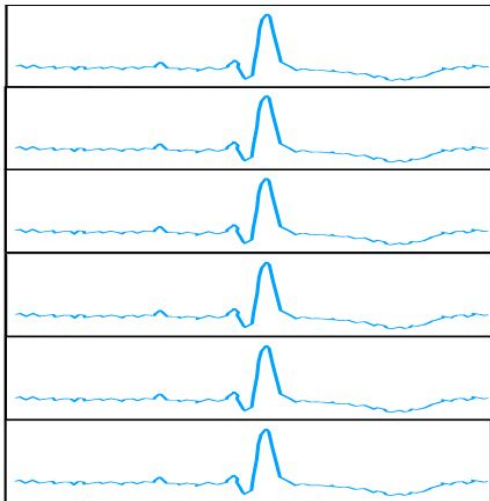
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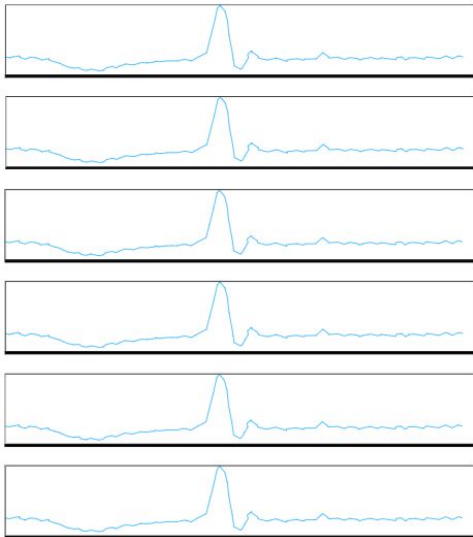
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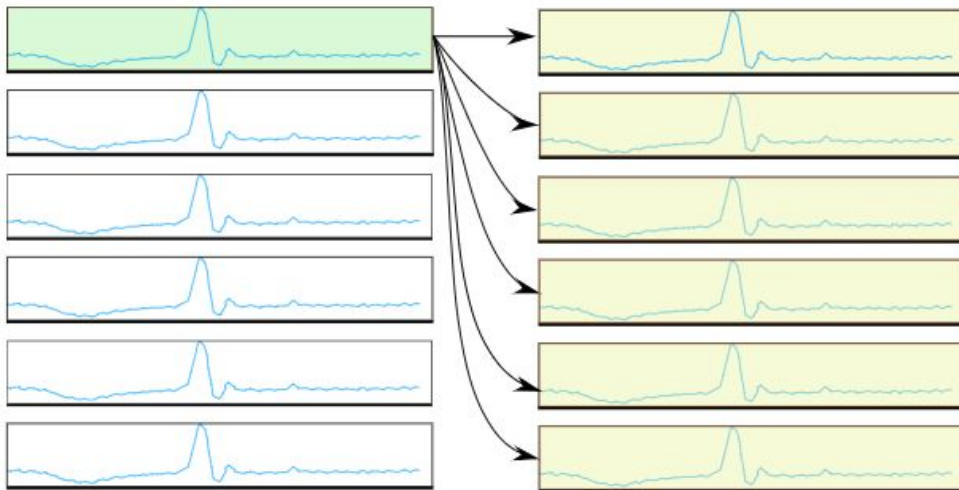
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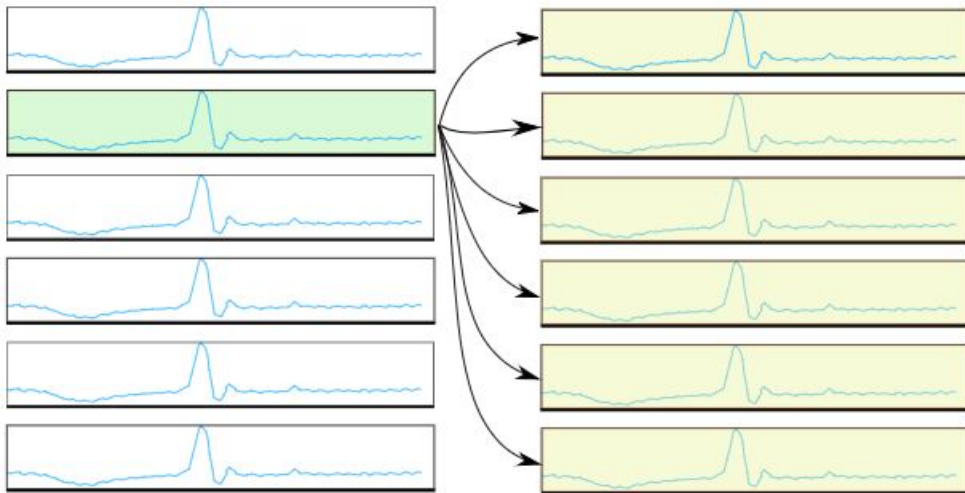
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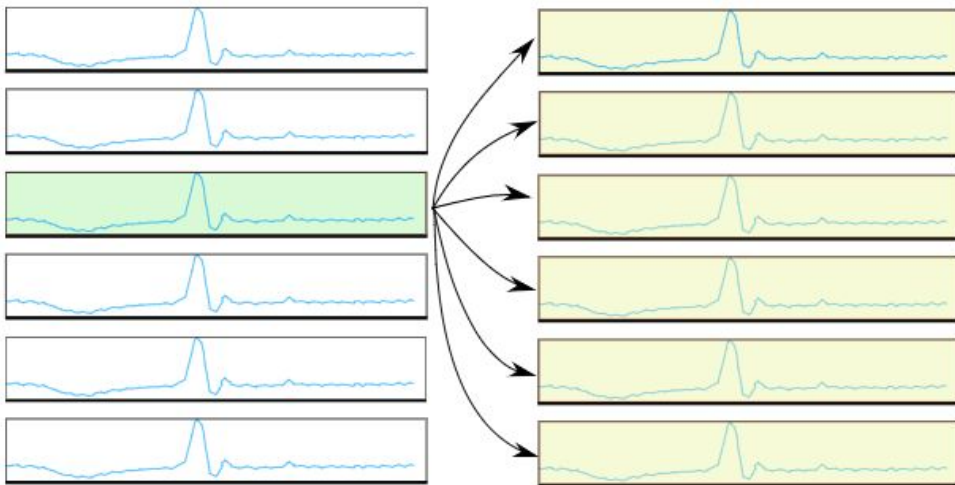
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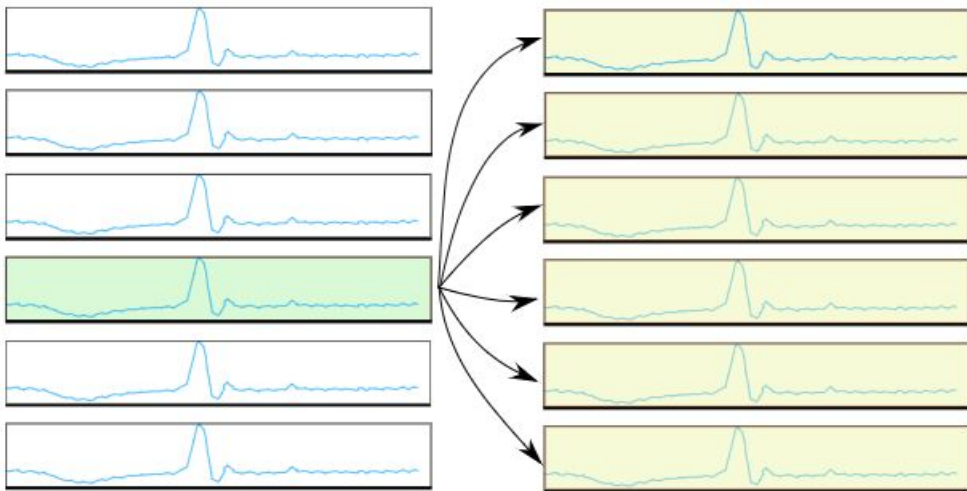
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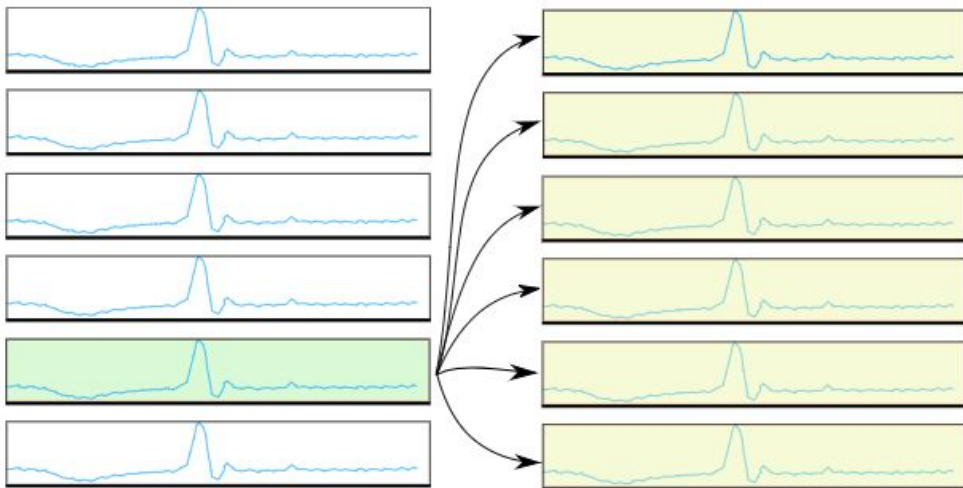
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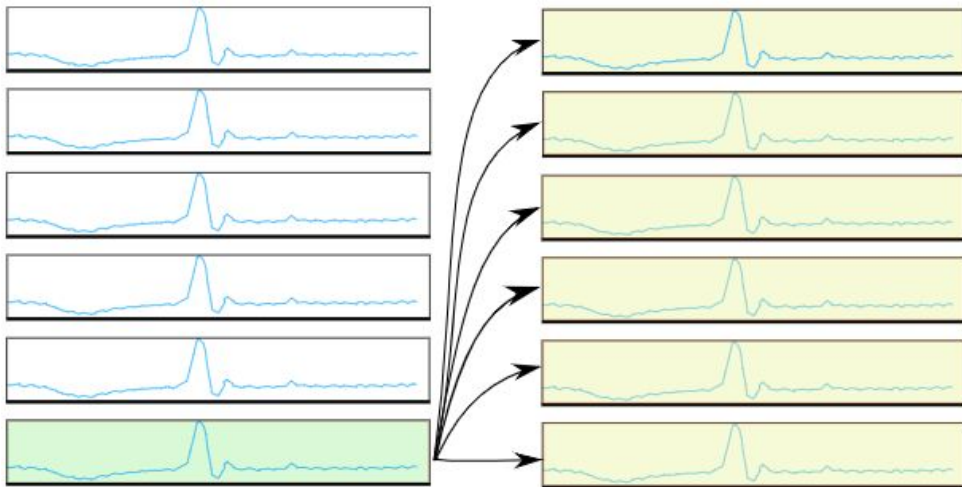
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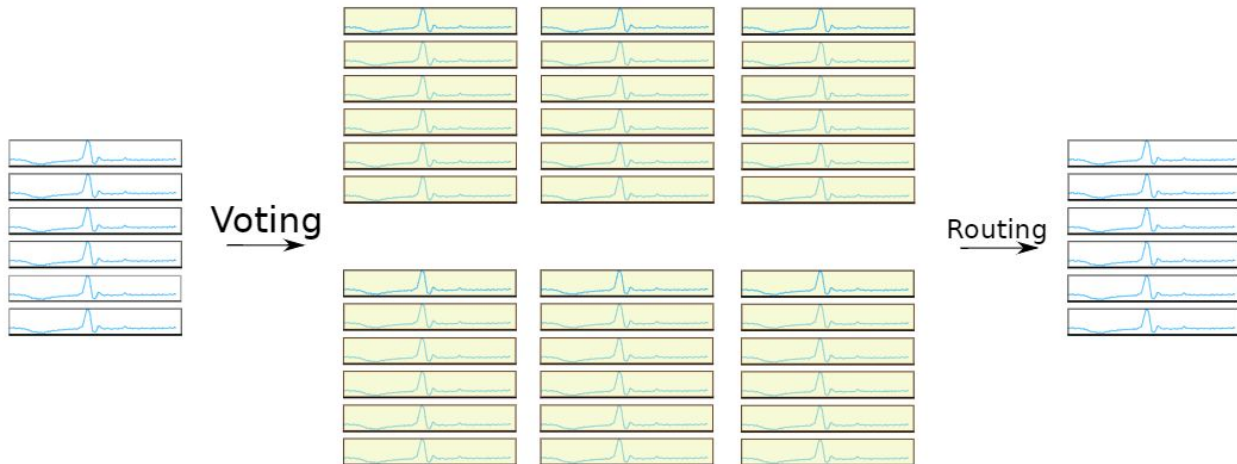
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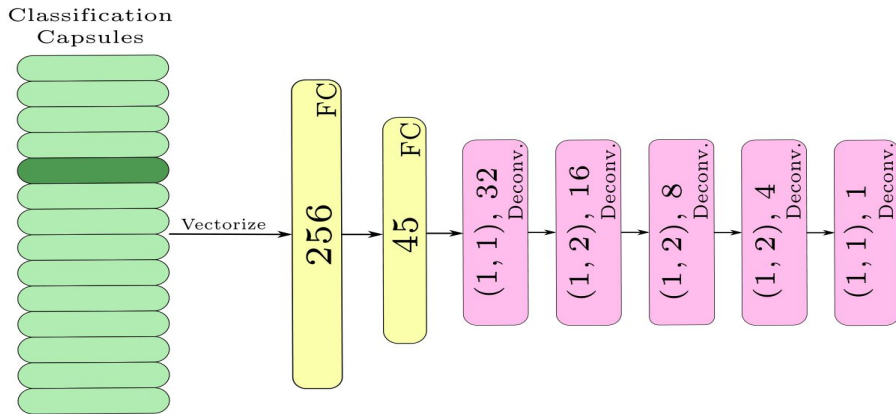
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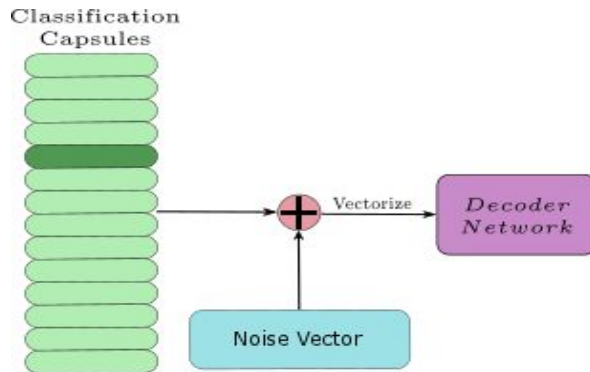
TimeCaps B



Class Independent Decoder



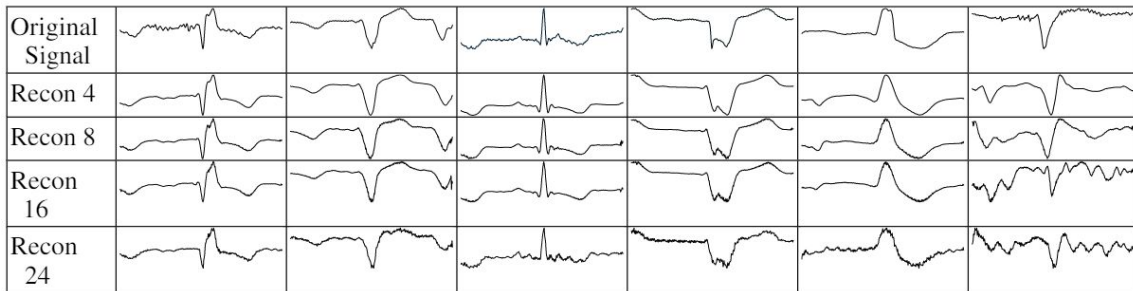
Signal Perturbation



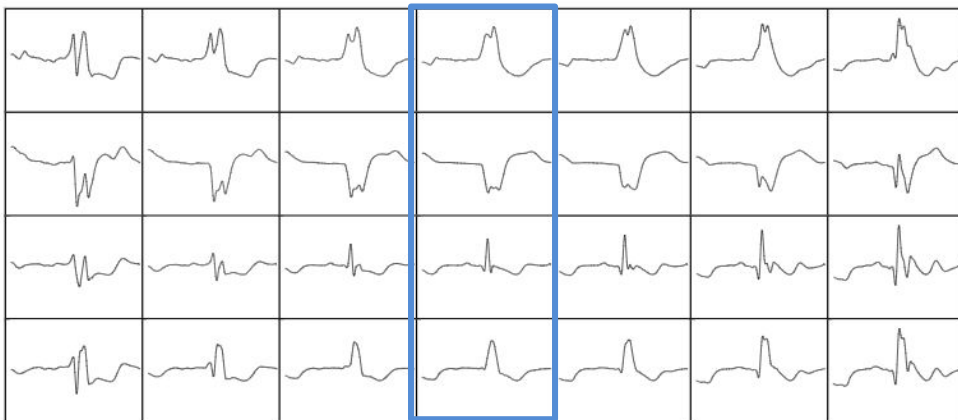
Classification Results

Implementation	Classes	Accuracy	Additional Information
Elhaj <i>et al.</i>	5	98.91%	AAMI classes (N,S,V,F,Q)
Rajkumar <i>et al.</i>	7	93.6%	(V,/,L,R,!,A,N)
TimeCaps	13	96.96%	All the beat types
TimeCaps	5	97.94%	AAMI classes (N,S,V,F,Q)

Reconstruction Results

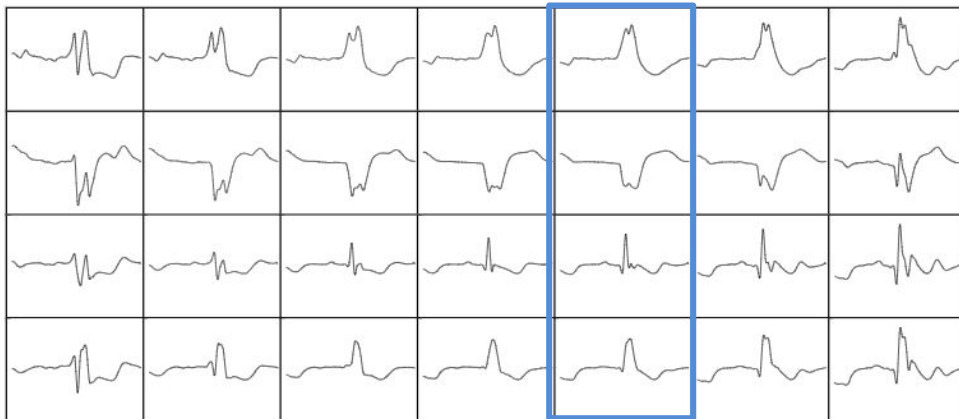


Signal Perturbation Results



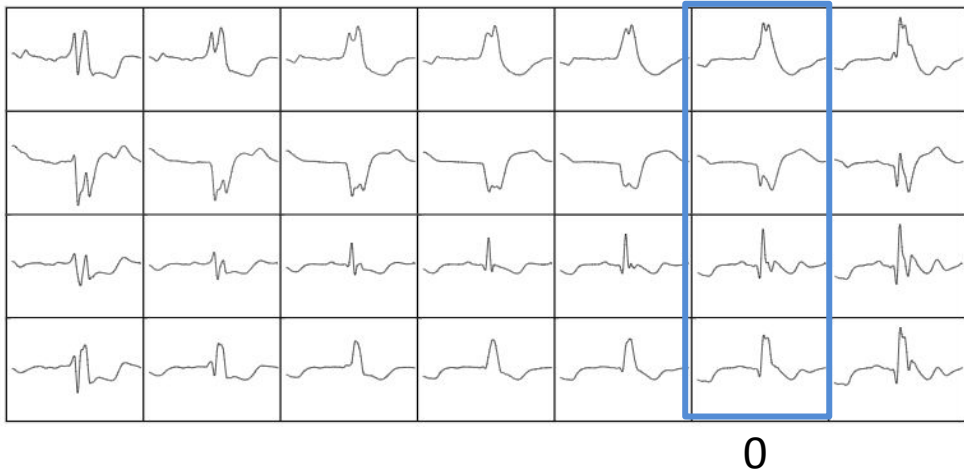
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Signal Perturbation Results

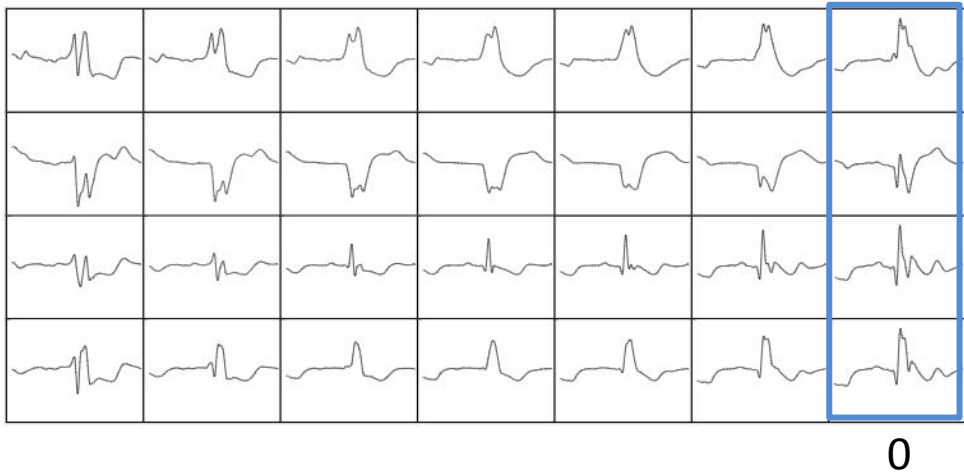


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Signal Perturbation Results



Signal Perturbation Results



Signal Perturbation Results



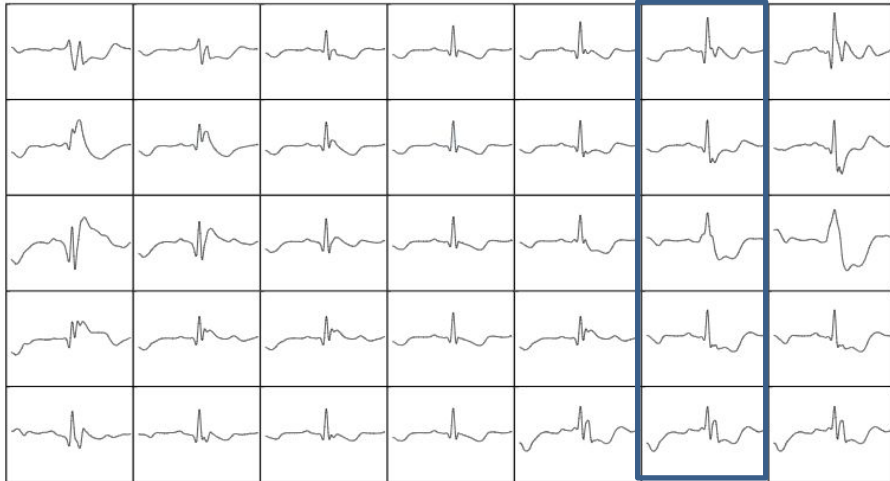
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Signal Perturbation Results



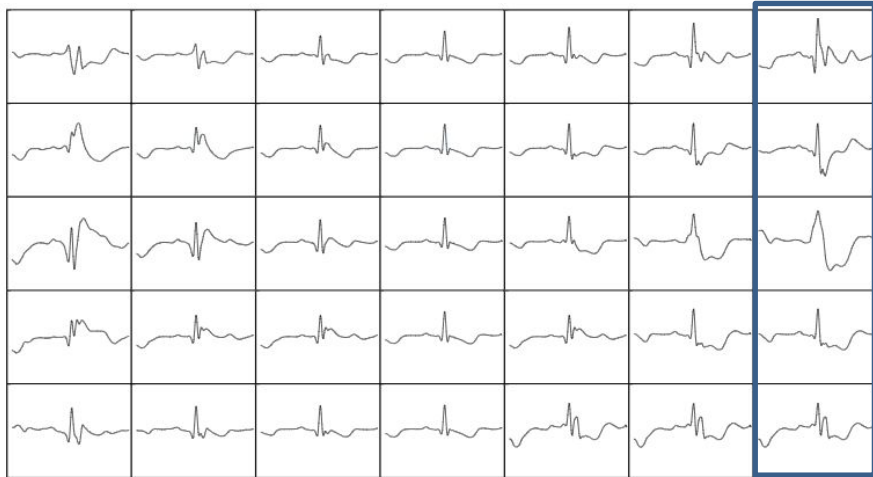
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Signal Perturbation Results



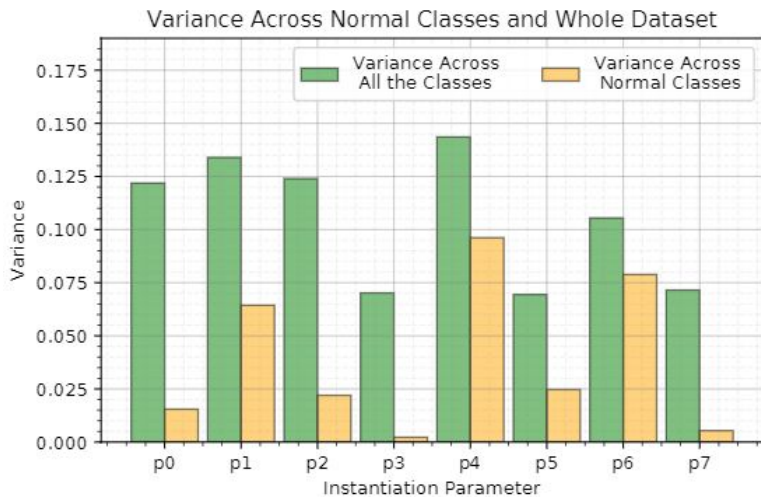
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Signal Perturbation Results



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Signal Perturbation Results



Thank You!