**Training phase** - learn parameters  $\theta$  and W from training data Feature Extraction Multilabel classification Extracted Multilabel classifier Encoder Encoder Decoder  $\hat{\mathbf{X}}_{tr}$  $\rightarrow h(\widehat{\mathbf{Y}}_{tr} \mid \mathbf{X'}_{tr}; W)$  $f_{\theta}$  $f_{\theta^*}$  $g_{\theta'}$ Raw Features para unique uniqu  $\mathbf{Y}_{tr}$ Reconstr. Labels After training the network **Testing phase** - use learned parameters  $\theta^*$  and  $W^*$  to infer protein functions Predictions Multilabel classifier Evaluation  $\hat{\mathbf{Y}}_{ts}$ Encoder  $\mathbf{X'}_{ts}$  $B(\mathbf{Y}_{ts}, \widehat{\mathbf{Y}}_{ts})$  $h(\widehat{\mathbf{Y}}_{ts} \mid \mathbf{X'}_{ts}; W^*)$  $f_{\theta^*}$  $\mathbf{Y}_{ts}$ Extracted Ground-truth