

Autoencoders - Testes e Aplicações

CPE 727 - Aprendizado de Profundo

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Santos e Jefferson Osowsky**

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Dataset

1 Autoencoder Simples

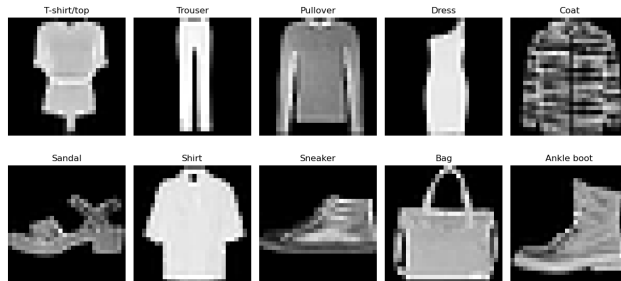
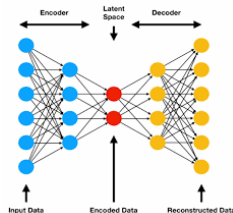


Figura: Fashion MNIST

Modelo

1 Autoencoder Simples

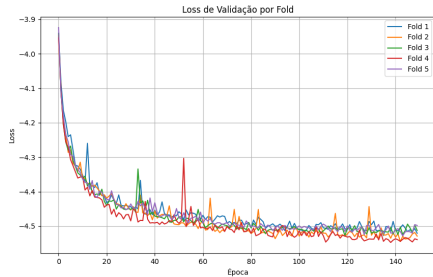
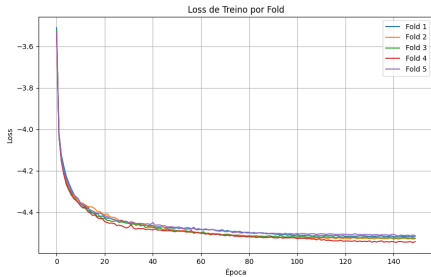
- Input: imagens 28x28x1 (Fashion MNIST)
- Encoder:
 - 2 Camadas Lineares (Fully Connected)
 - Primeira camada: transforma $28 \times 28 \rightarrow 128$ unidades
 - Segunda camada: transforma $128 \rightarrow 64$ unidades
 - Função de ativação ReLU após cada camada
- Decoder:
 - 2 Camadas Lineares (Fully Connected)
 - Primeira camada: transforma $64 \rightarrow 128$ unidades
 - Segunda camada: transforma $128 \rightarrow 28 \times 28$ unidades
 - Função de ativação ReLU nas camadas intermediárias
 - Ativação final Sigmoid para normalizar a saída em $[0, 1]$



- Aplicação de **K-Fold Cross-Validation** ($K=5$).
- Learning Rate de 0.0003.
- 150 épocas.
- Treinamento separado para cada fold.
- Uso do otimizador **Adam**.
- Loss MSE.
- Cálculo do **SSIM** na validação.
- Treinamento final utilizando todo o dataset.

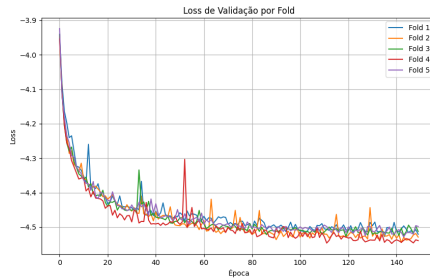
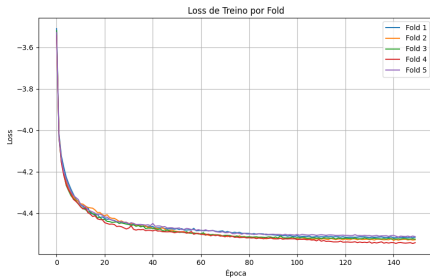
Resultados

1 Autoencoder Simples



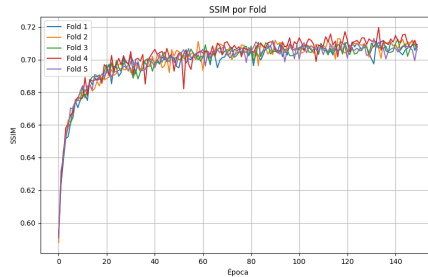
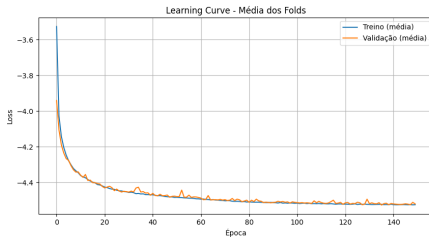
Resultados

1 Autoencoder Simples



Resultados

1 Autoencoder Simples



Resultado - Reconstrução da imagem

1 Autoencoder Simples

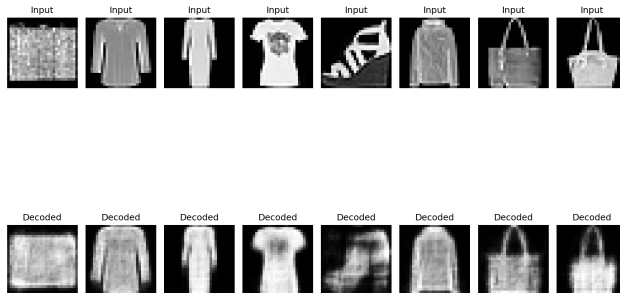


Figura: Output do modelo - SSIM 0.7 no conjunto de teste

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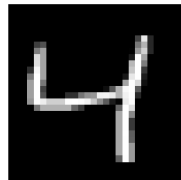
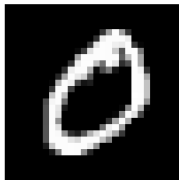
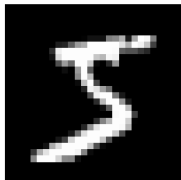
2 Denoising Autoencoder

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Dataset

2 Denoising Autoencoder

MNIST Dataset



Noisy MNIST Dataset

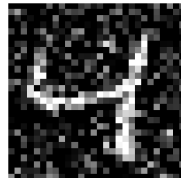
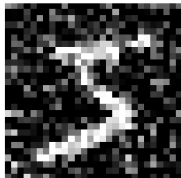


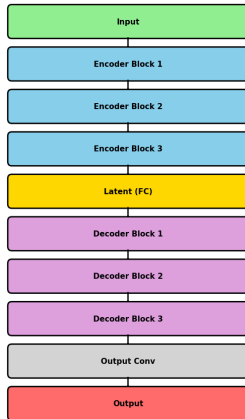
Figura: Imagens do MNIST e Noisy MNIST. Ruído Gaussiano com 0.3 de desvio padrão.

Modelo

2 Denoising Autoencoder

- Input: imagens 28x28x1 (Noisy MNIST)
- Encoder:
 - 3 Camadas Convolucionais (Kernel 3x3 e Stride 1)
 - BatchNorm
 - ReLU
 - MaxPooling(Kernel 2x2, Stride 2)
- Decoder:
 - 2 Camadas Convolucionais T. (Kernel 3x3 e Stride 2)
 - BatchNorm
 - ReLU
 - Camada Convolutacional T. Final (Kernel 3x3, Stride 1)
 - Sigmoid

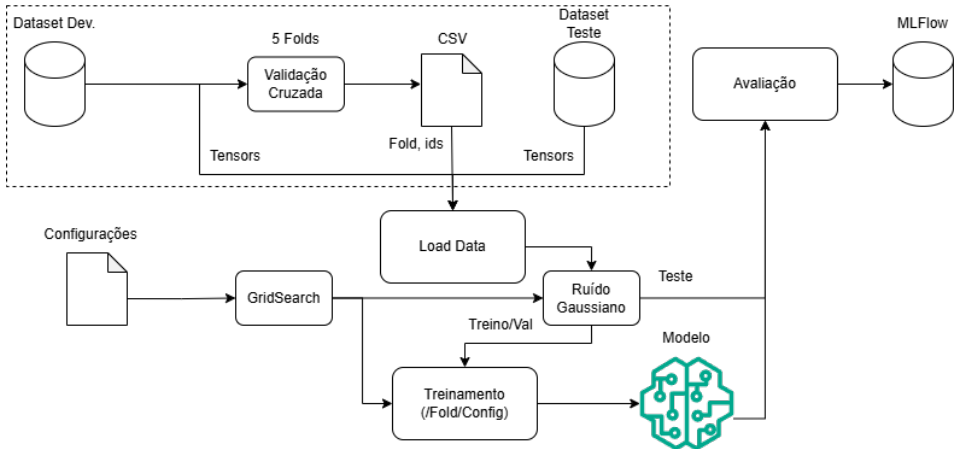
Denoising Autoencoder Architecture



Metodologia

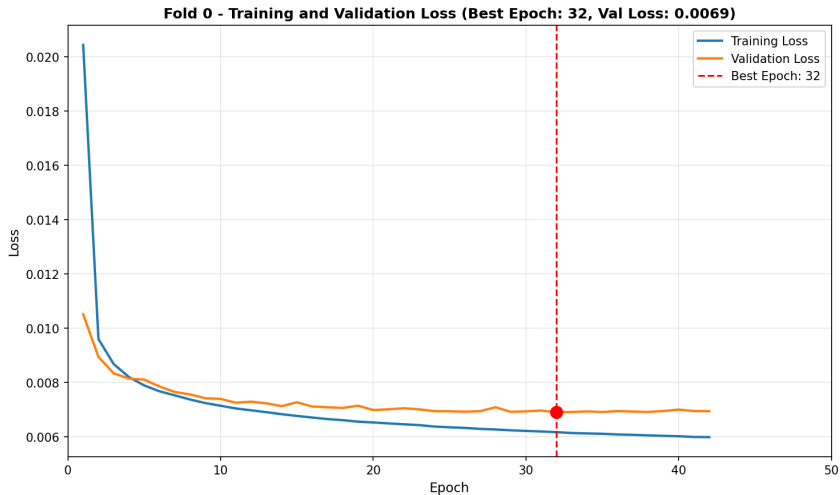
2 Denoising Autoencoder

Data Loaders



Treinamento

2 Denoising Autoencoder



Resultado - Denoising

2 Denoising Autoencoder

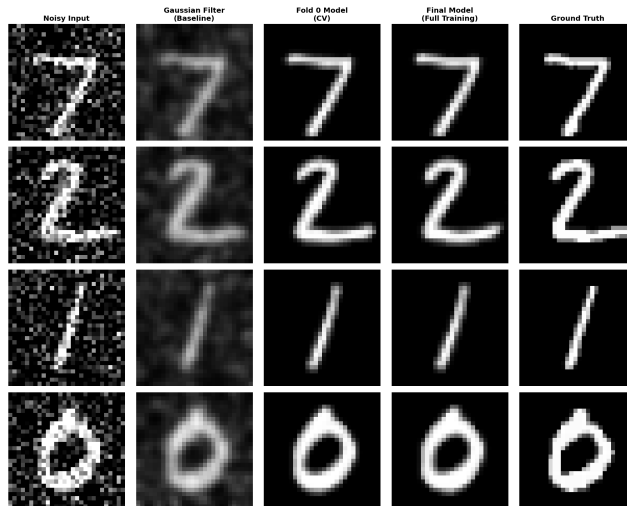


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Reuter Corpus V1

3 Reuter Corpus com Autoencoder

- Coleção de 804.414 artigos de notícias da Reuters (1996-1997)
- 103 categorias de tópicos organizadas hierarquicamente
- Classificação multi-label: cada documento pode pertencer a múltiplas categorias
- Categorias abrangem temas como economia, política, esportes, tecnologia, etc.

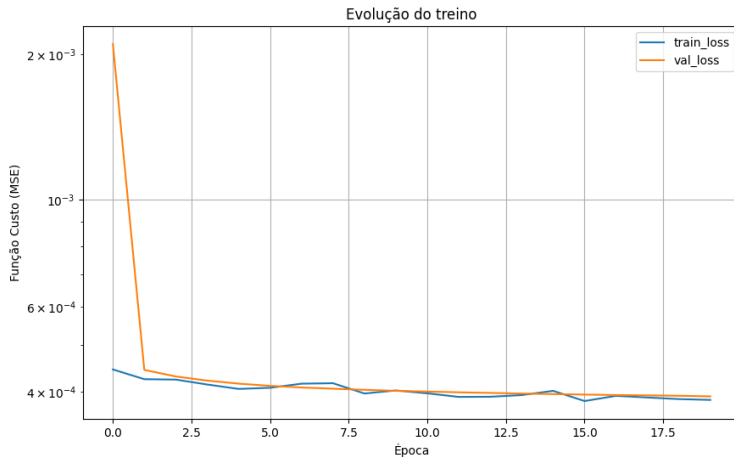
Método

3 Reuter Corpus com Autoencoder

- Objetivo: Replicar o plot do Hinton (2006)
- Autoencoder com mesma arquitetura (2000, 500, 250, 125, 2)
- Ativação linear na camada do espaço latente, e Leaky ReLU nas demais
- Otimização com AdamW, sem pré-treino

Evolução do treino

3 Reuter Corpus com Autoencoder



Resultado

3 Reuter Corpus com Autoencoder

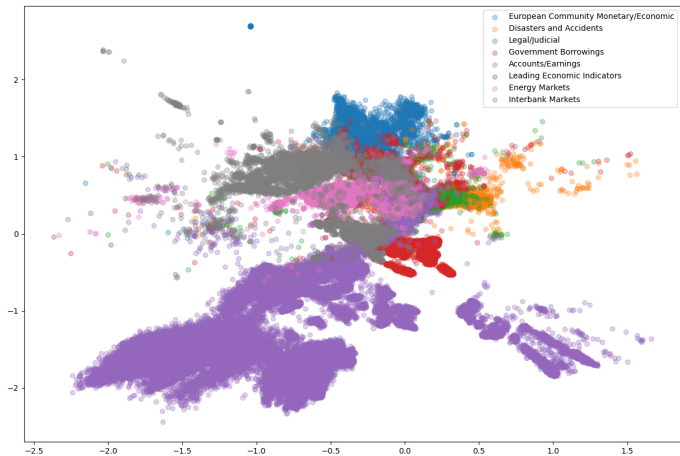


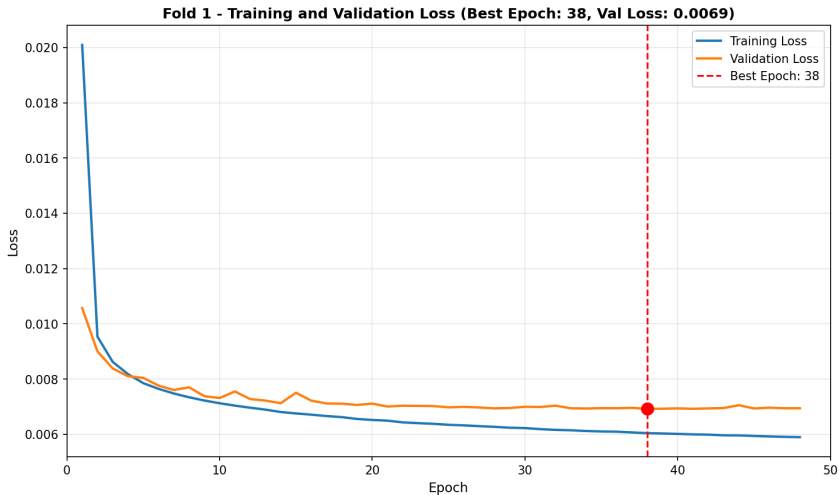
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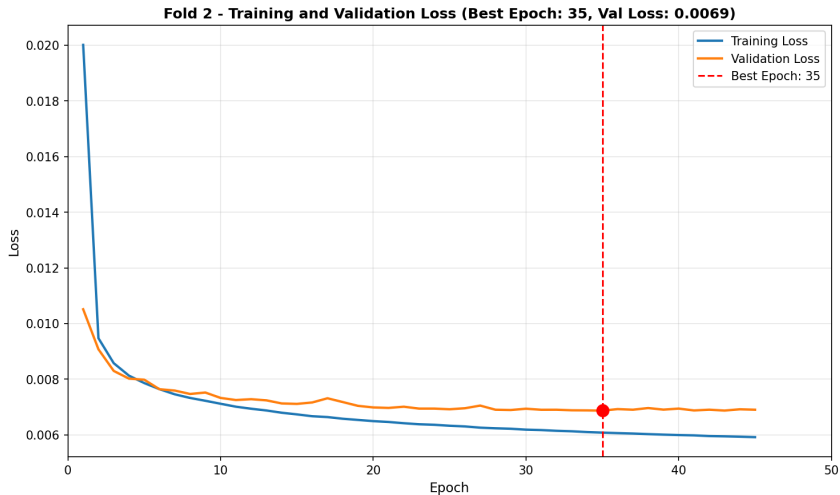
Treinamento

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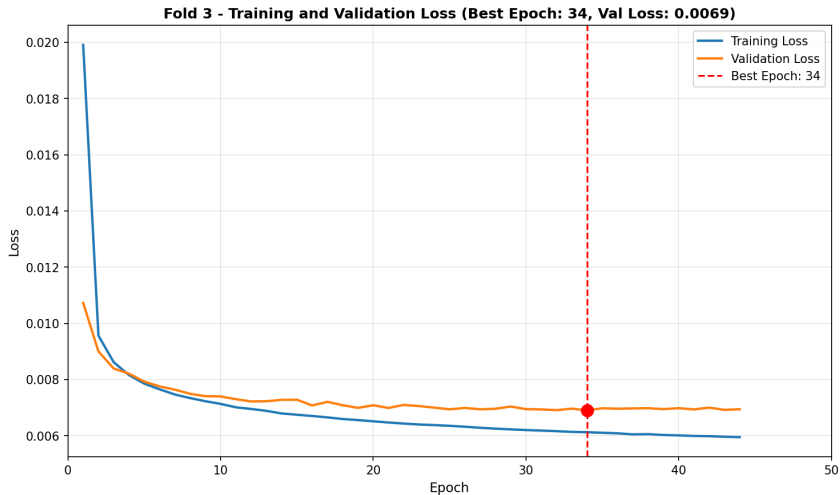
Treinamento

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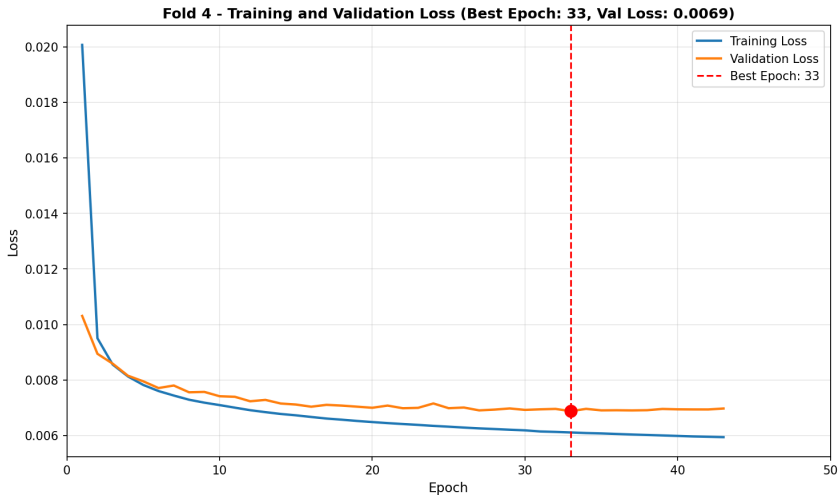
Treinamento

4 Anexos



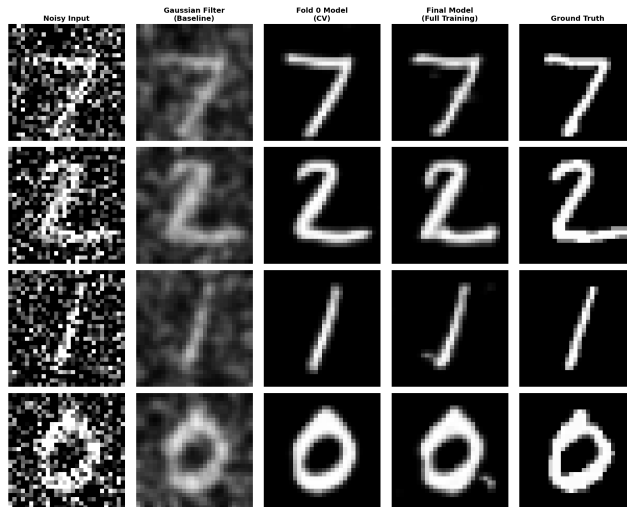
Treinamento

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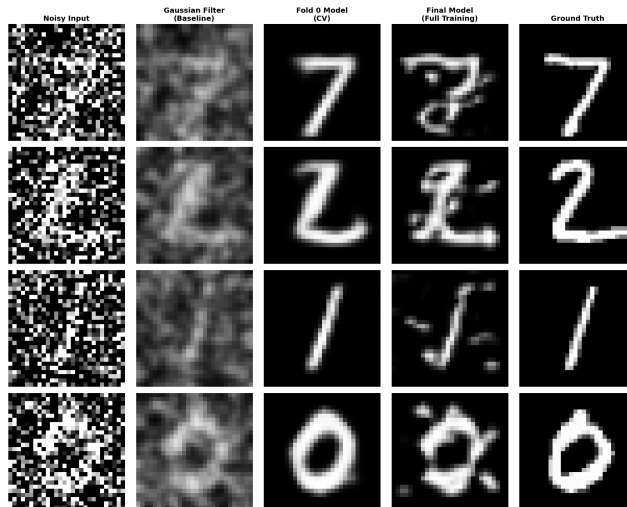
Resultado - Denoising

4 Anexos



Resultado - Denoising

4 Anexos



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Obrigado pela Atenção!

Alguma Pergunta?

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