Curso Redes Neuronales

Profundización en modelos y técnicas avanzadas

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January 17, 2025

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Repaso - Entrenamiento

- Inicialización (Automático)
- Entrenamiento
  1. Cargar muestras (por lotes)
  2. Pasar las muestras por la red y obtener una predicción $\rightarrow$ Forward-Pass
  3. Comparar con el resultado esperado $\rightarrow$ Función de pérdida
  4. Calcular el gradiente de cada parámetro $\rightarrow$ Backward-Pass (AutoGrad)
  5. Actualizar los parámetros $\rightarrow$ Optimizador
  6. Volver al punto 1
- Inferencia

Repaso - Capas

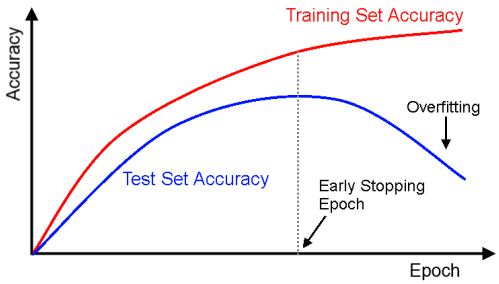
Con parámetros entrenables:

- Densa, Fully-Connected o Linear
- Convolucional
- Batch Normalization

Transformaciones y activaciones:

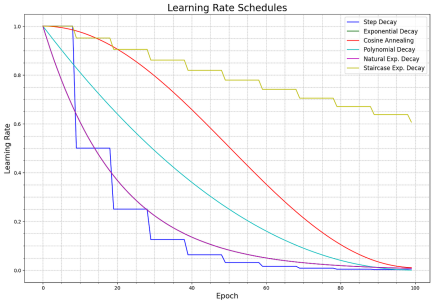
- Pooling (junto a convoluciones)
- ReLU (activación)
- Softmax
- Flatten (aplanado)

Overfitting



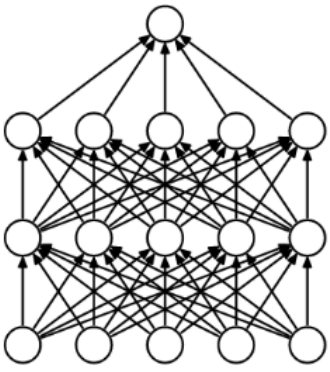

```
if val_loss < best_val_loss:
    best_val_loss = val_loss
    best_model_weights =
        model.state_dict()
    epochs_no_improve = 0
else:
    epochs_no_improve += 1
if epochs_no_improve >= patience:
    break
```

Learning Rate variable

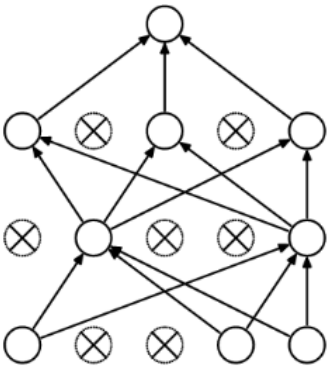



```
1 for epoch in range(n_epochs):
2   cosine_decay = 0.5 * (1 + cos(pi *
        epoch / num_epochs))
3   new_lr = lr_min + (initial_lr -
        lr_min) * cosine_decay
4   for param_group in
        optimizer.param_groups:
5       param_group['lr'] = new_lr
```

Capas Dropout

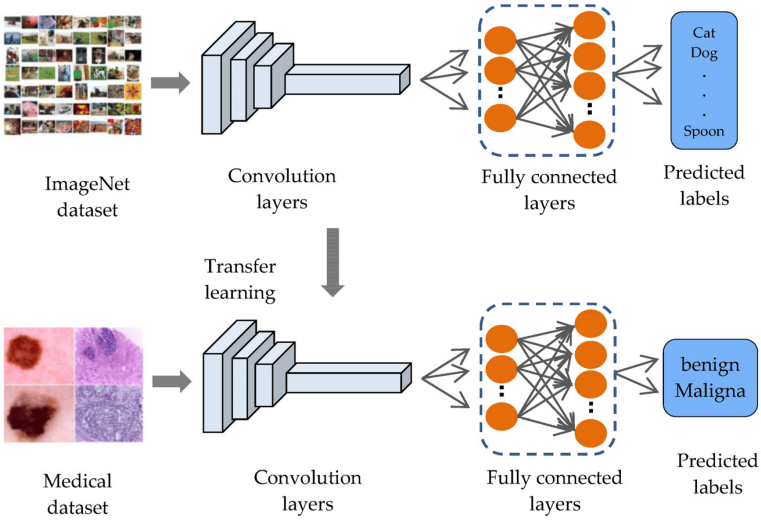


(a) Standard Neural Net

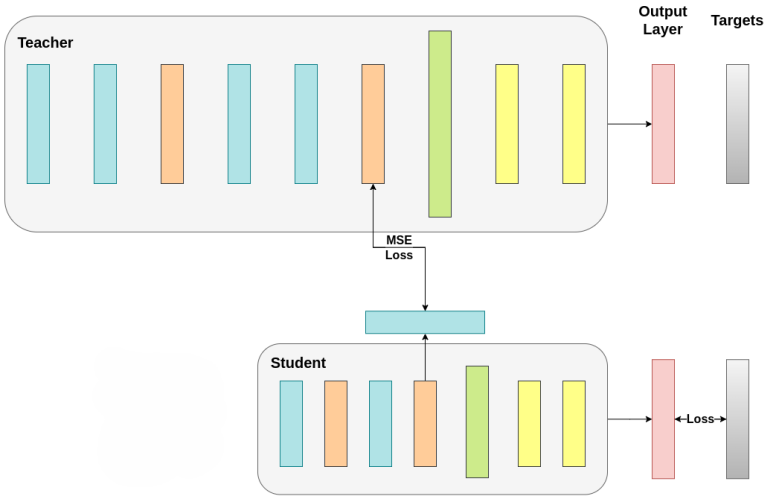


(b) After applying dropout.

Transferencia de conocimiento

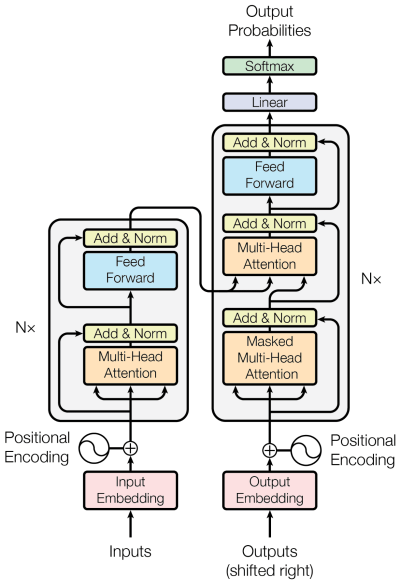


Destilar el conocimiento

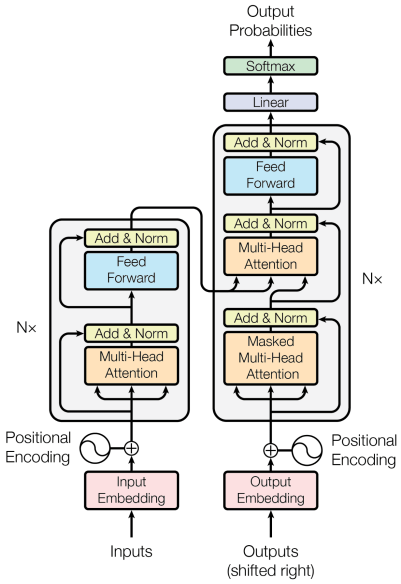


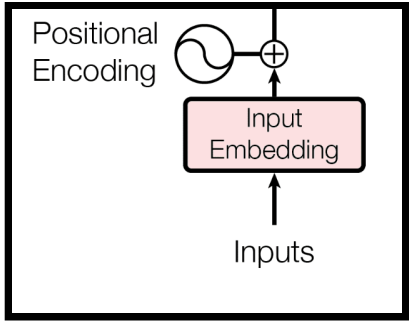
Attention Is All You Need

Transformer

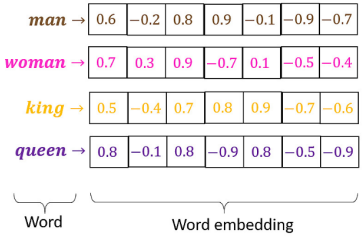


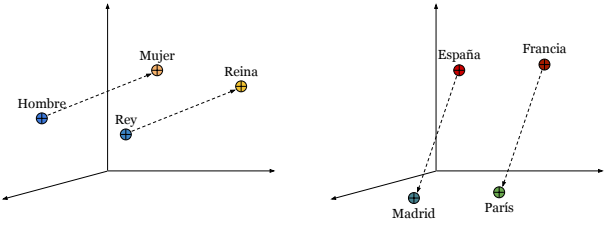
Transformer





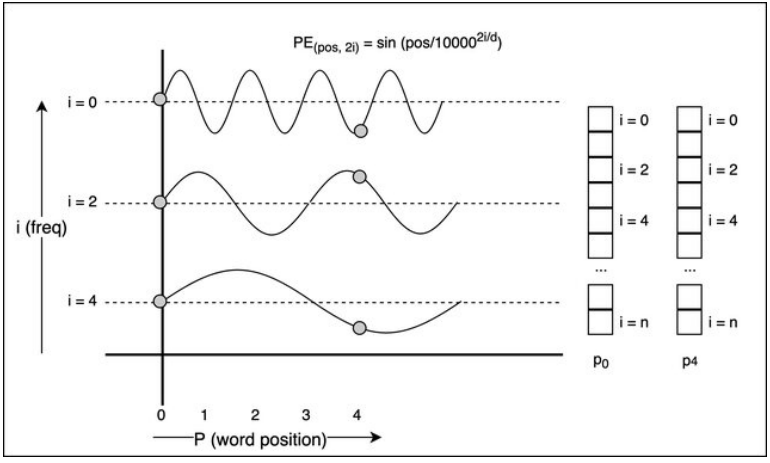
Embeddings





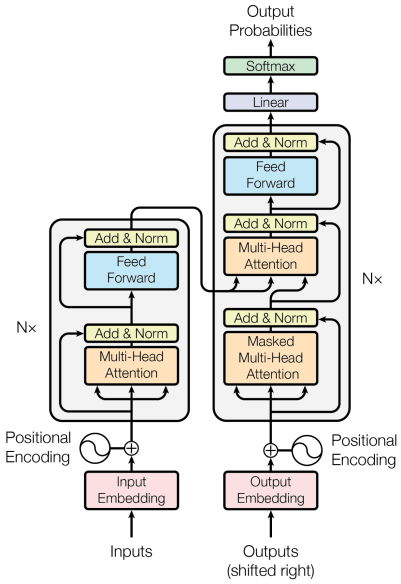
GPT-3 tiene **12.288 dimensiones** y **50.257 "palabras" (tokens)**

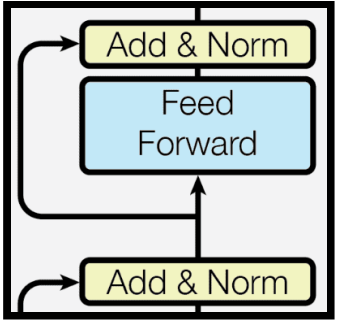
Positional Encoding



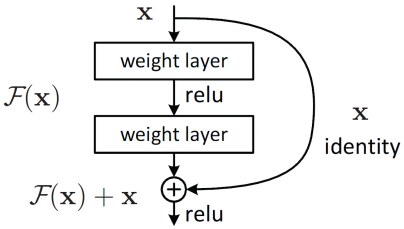
Contexto de 2.048 tokens

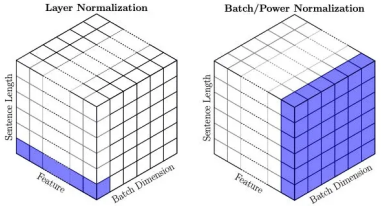
Transformer



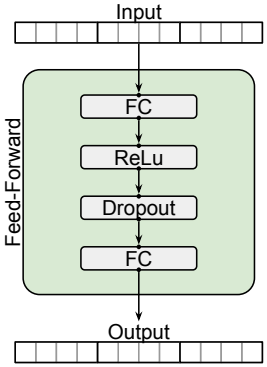


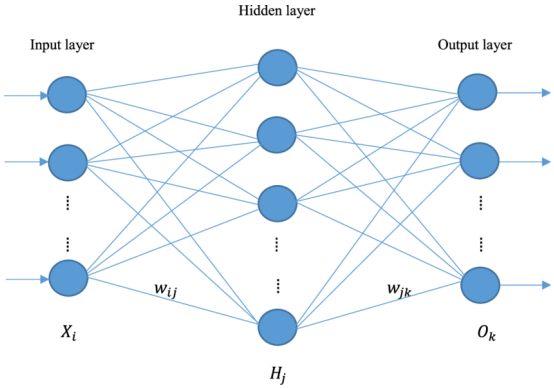
Add & Norm


x
weight layer
relu
weight layer
F(x)
x
identity
F(x) + x
relu

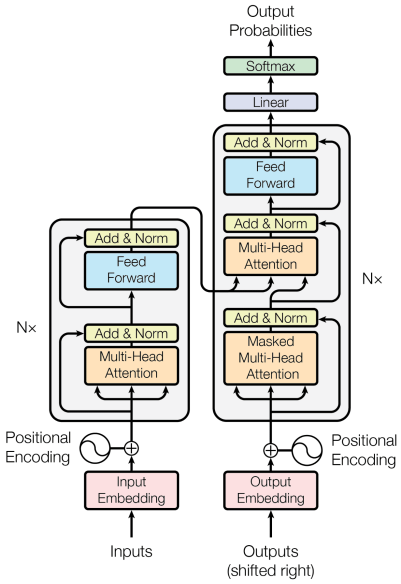

Layer Normalization
Batch/Power Normalization
Sentence Length
Feature
Batch Dimension
Sentence Length
Feature
Batch Dimension

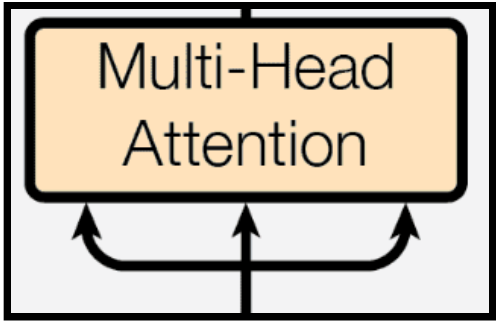
Feed Forward



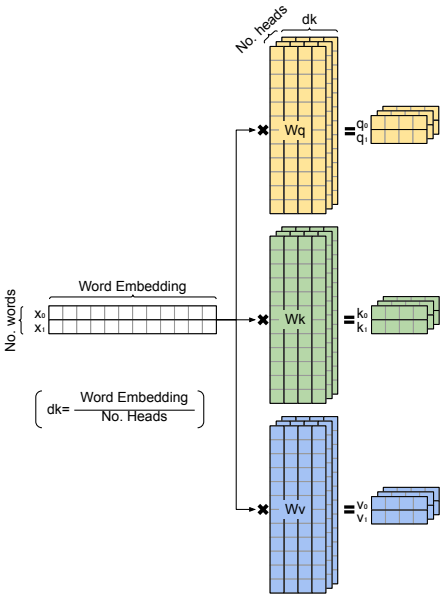


Transformer

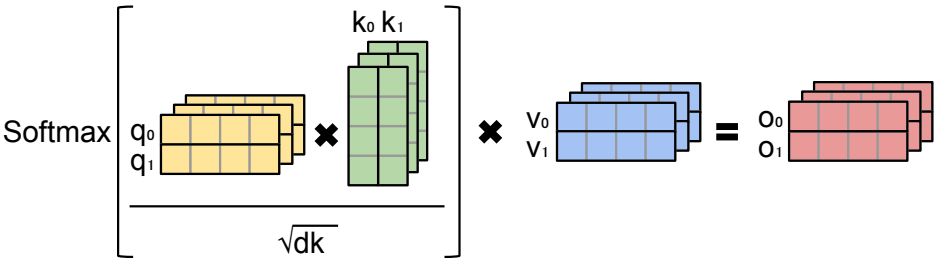




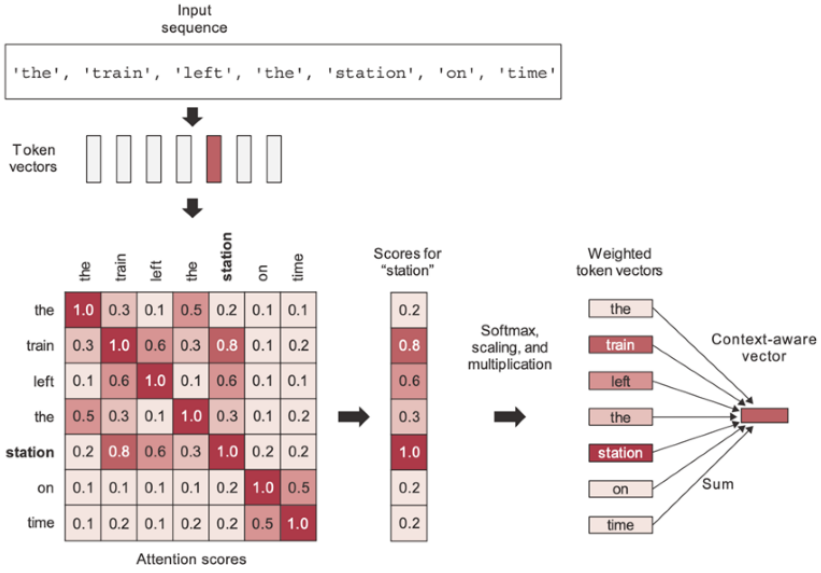
Multi-Head Attention



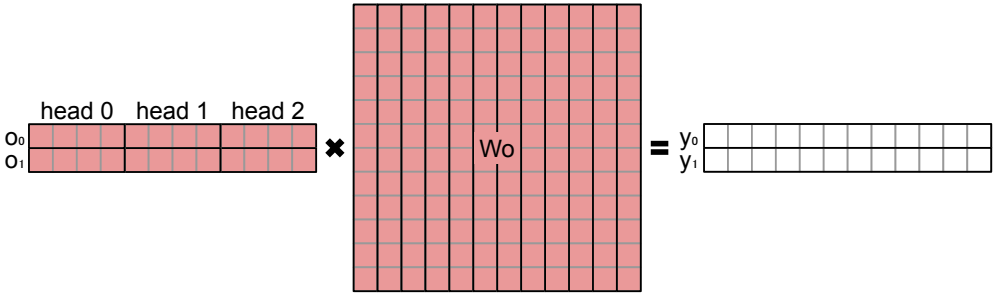
Multi-Head Attention



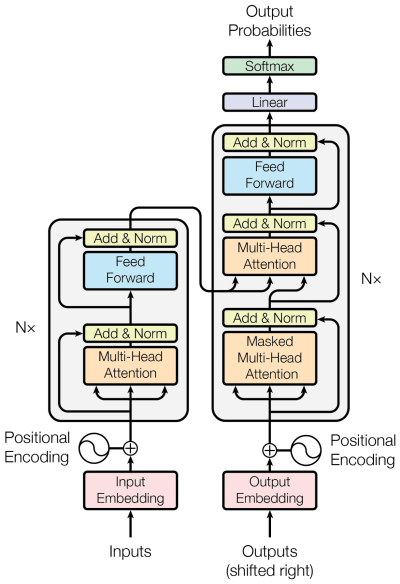
Multi-Head Attention



Multi-Head Attention



Transformer



Modelos prediseñados

https://pytorch.org/vision/0.20/modelsclassification

```python
from torchvision import models

model = models.alexnet()
print(model)

for pretrained_weights in models.get_model_weights("alexnet"):
    print(pretrained_weights)
model = models.alexnet(weights="AlexNet_Weights.IMAGENET1K_V1")
```

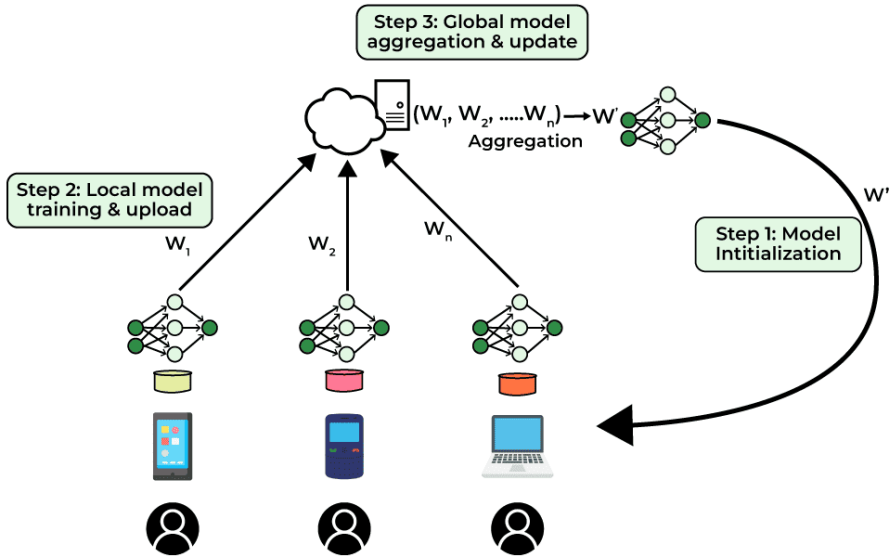
Práctica

https://github.com/jmiravet/curso_ia.git

Líneas de investigación

- Poda de parámetros (optimización)
- Cuantización (optimización)
- Fusión de capas (optimización)
- Métodos para identificar y mitigar sesgos
- Interpretabilidad y explicabilidad
- Tolerancia a fallos
- Privacidad en compartición de datasets: aprendizaje federado
- Aplicaciones: Simular funciones con alto coste computacional. Ayuda en toma de decisiones en problemas complejos.

Aprendizaje federado



Interpretabilidad