Google Developer Experts

Diabetic Retinopathy Grade Classification using Vision Transformers

Workshop

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About Me

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Overview

Plan

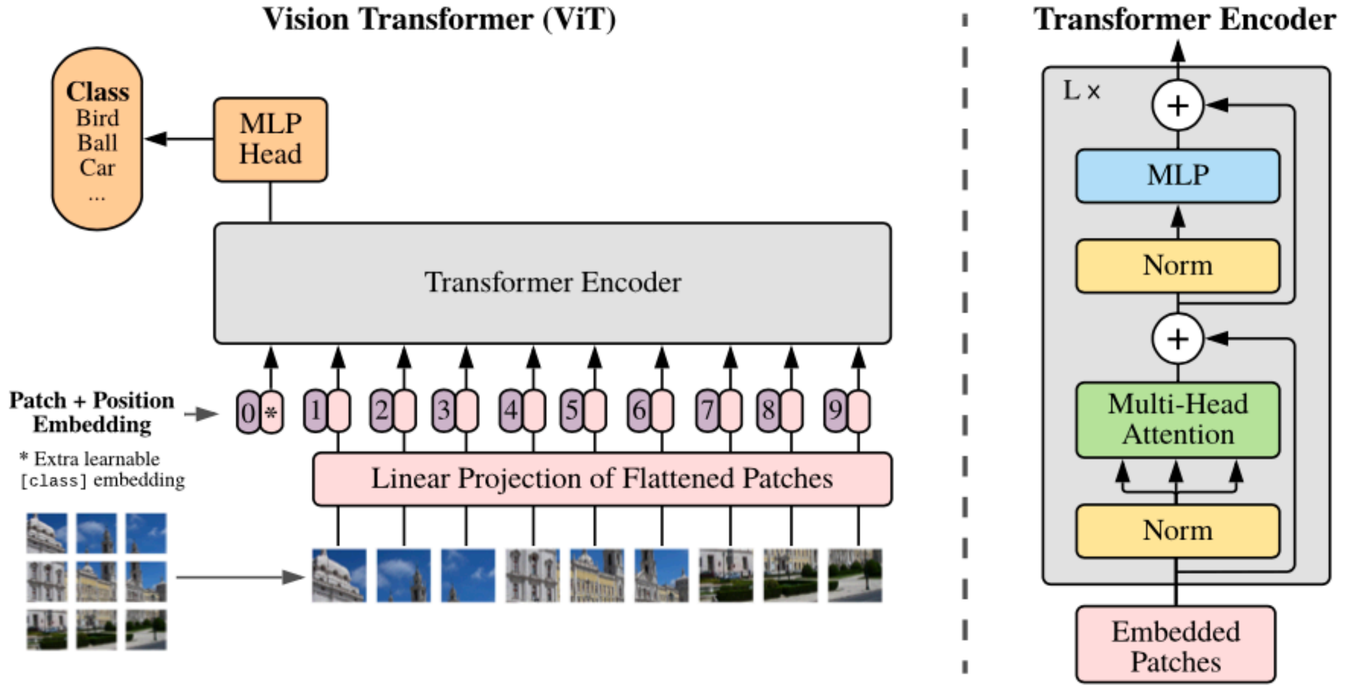
- Vision Transformers
- CNN vs Vision Transformers
- Diabetic Retinopathy
- Workshop

Vision Transformers

Introduction

The Vision Transformer, or ViT, image classification model that employs a Transformer-like architecture over patches of the image.
(1) An image is split into fixed-size patches,
(2) Each image is then linearly embedded,
(3) Position embeddings are added,
And the resulting sequence of vectors is fed to a standard Transformer encoder.

To perform classification, an extra learnable “classification token” is added to the sequence.



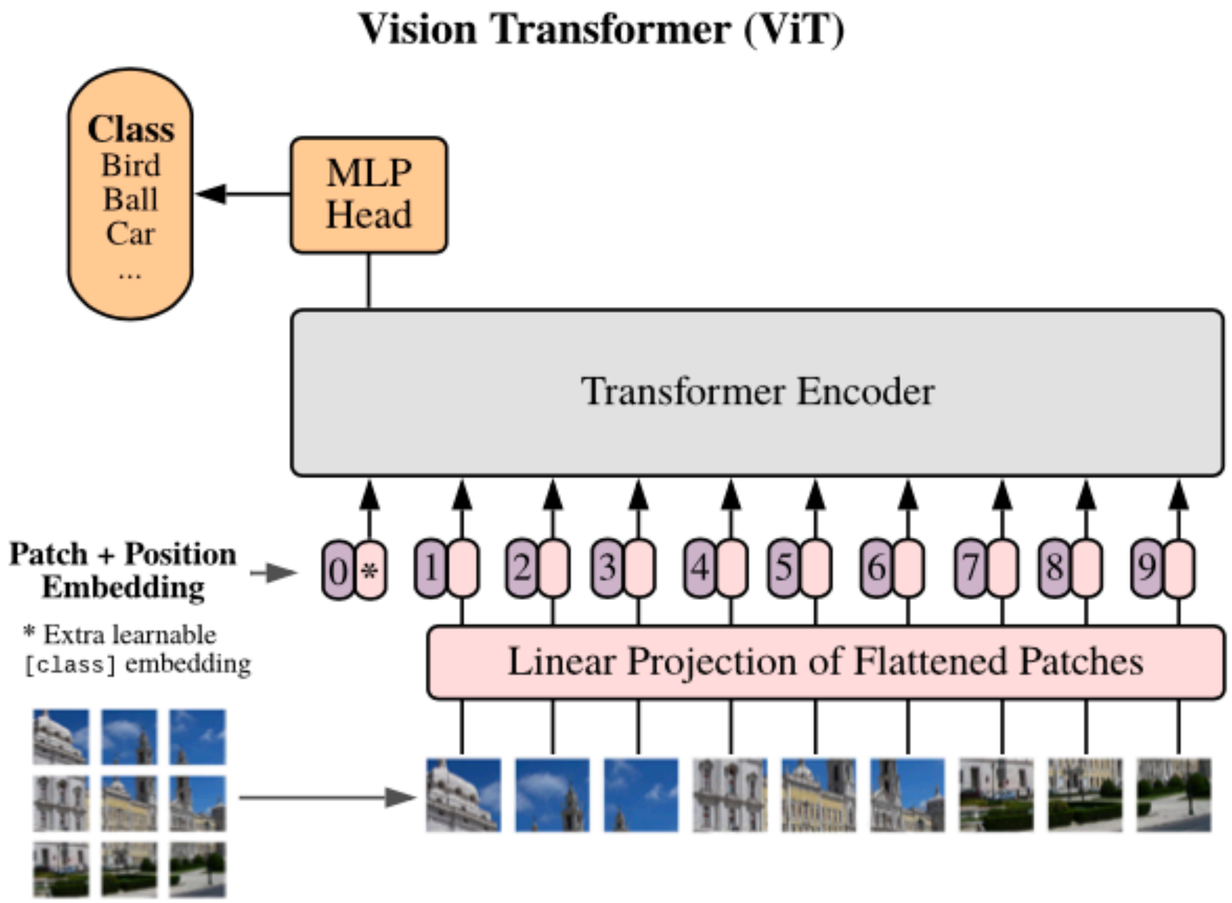
Source: An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale (paper by Dosovitskiy et al.)

Source: Lilian Weng

Source: Attention Is All You Need

Introduction

Architecture



Source: Lilian Weng

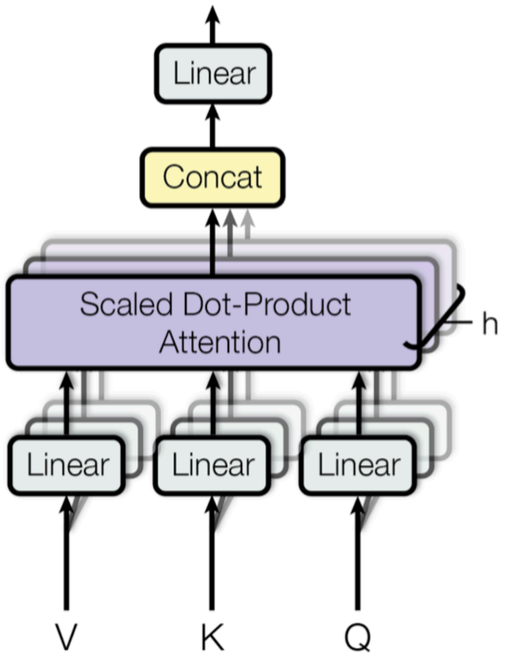
Source: Attention Is All You Need

Introduction

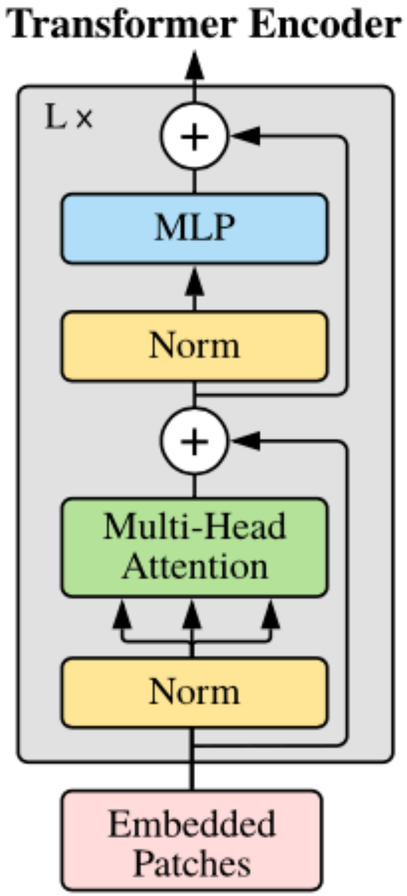
Transformer Encoder part

$$\text{MultiHead}(\mathbf{Q}, \mathbf{K}, \mathbf{V}) = [\text{head}_1, \ldots, \text{head}_h]\mathbf{W}_0$$

$$\text{where head}_i = \text{Attention}\left(\mathbf{Q}\mathbf{W}_i^Q, \mathbf{K}\mathbf{W}_i^K, \mathbf{V}\mathbf{W}_i^V\right)$$



Multi-Head Attention



Source: Lilian Weng

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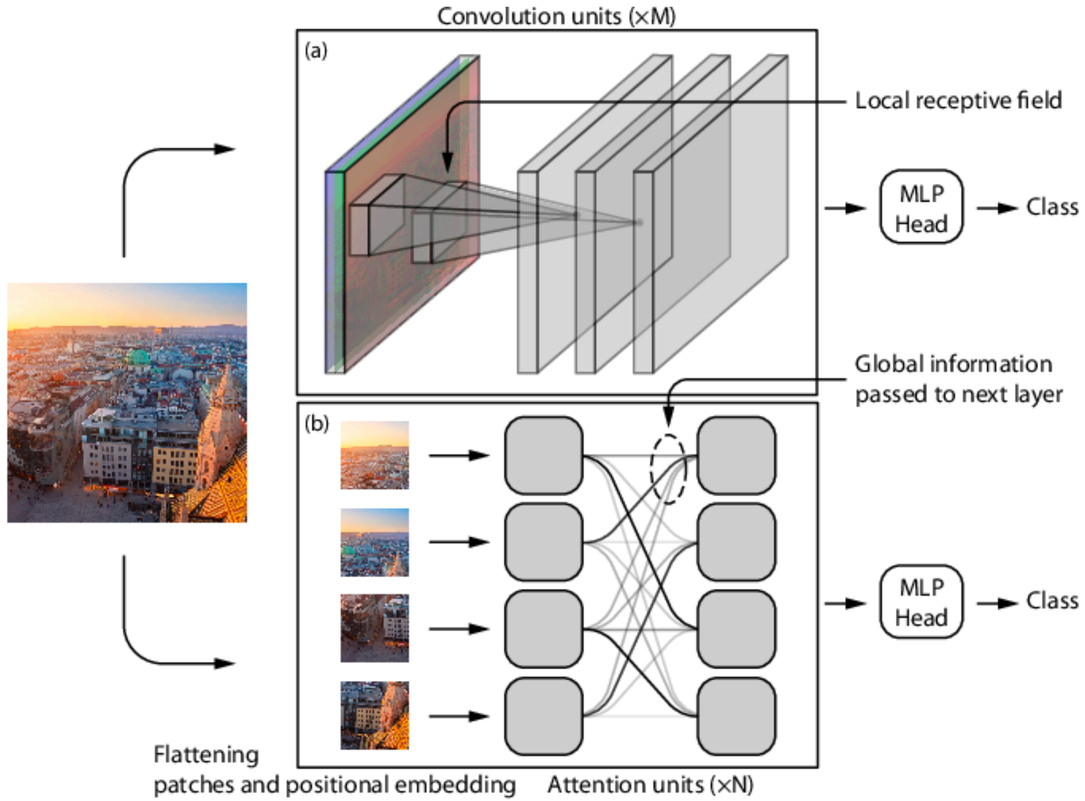
CNN vs ViT

Image representation



Source: [Are Convolutional Neural Networks or Transformers more like human vision?](#)

Shikhar Tuli et al.

CNNs vs ViTs

CNNs:

- Focus on local information
- Needs more training time
- Lots of resources
- Vulnerable to adversarial attacks or changes in the data

ViTs:

- Focus on global information
- Needs less training time
- Resources friendly
- Robust against adversarial attacks

Diabetic Retinopathy

Definition

Diabetic Retinopathy worldwide

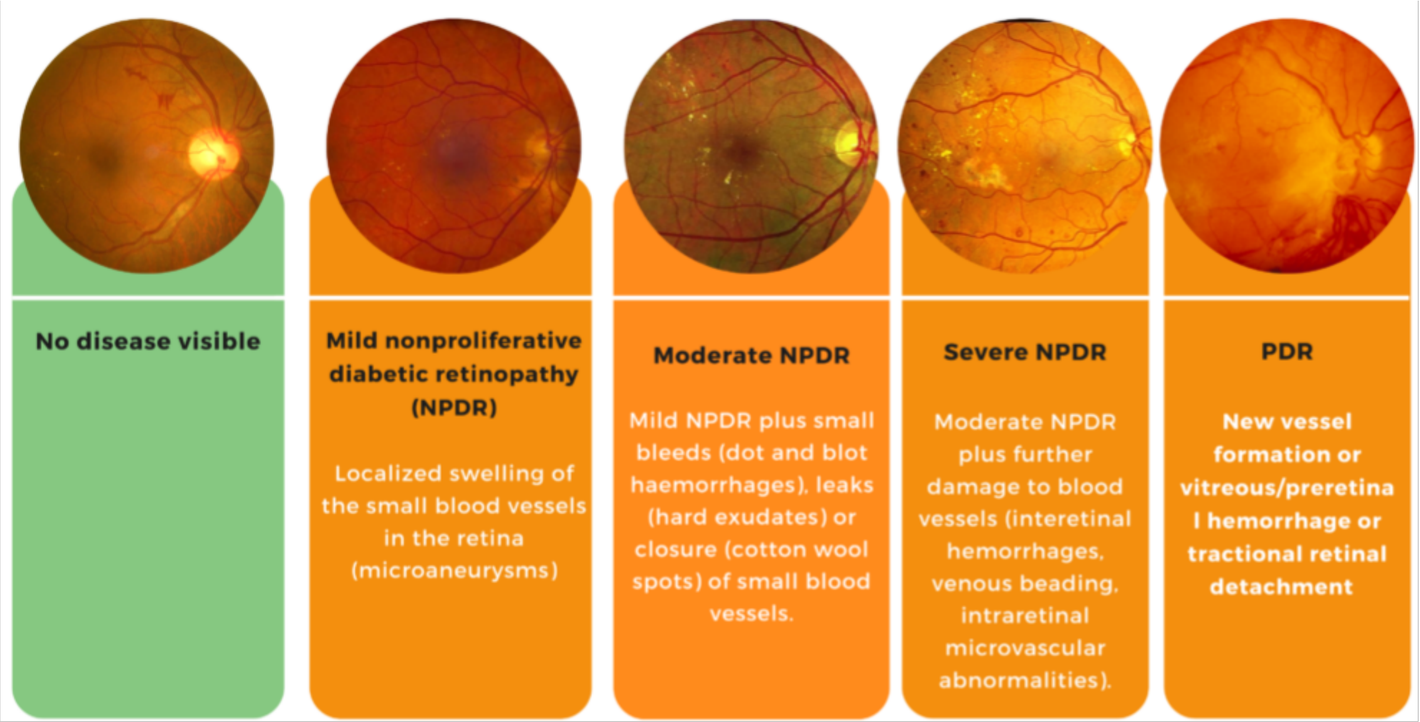
‘Diabetic Retinopathy (DR) is a complication of diabetes, caused by high blood sugar levels damaging the back of the eye (retina). It can cause blindness if left undiagnosed and untreated.’

Source: NHS UK

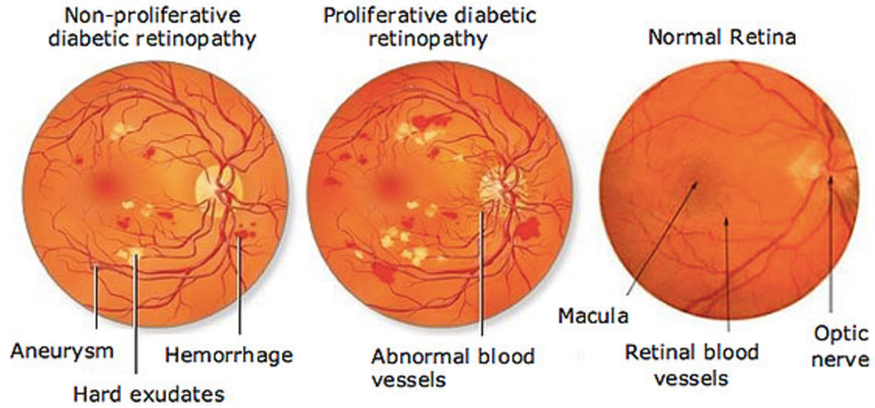
‘Globally, the number of people with DR will grow from 126.6 million in 2010 to 191.0 million by 2030.’

Source: 10.4103/0301-4738.100542

Grades & Symptoms



Source: https://www.ophthalytics.com/our-technology/diabetic-retinopathy/



Source: https://lowvisionaids.org/diabetic-retinopathy/

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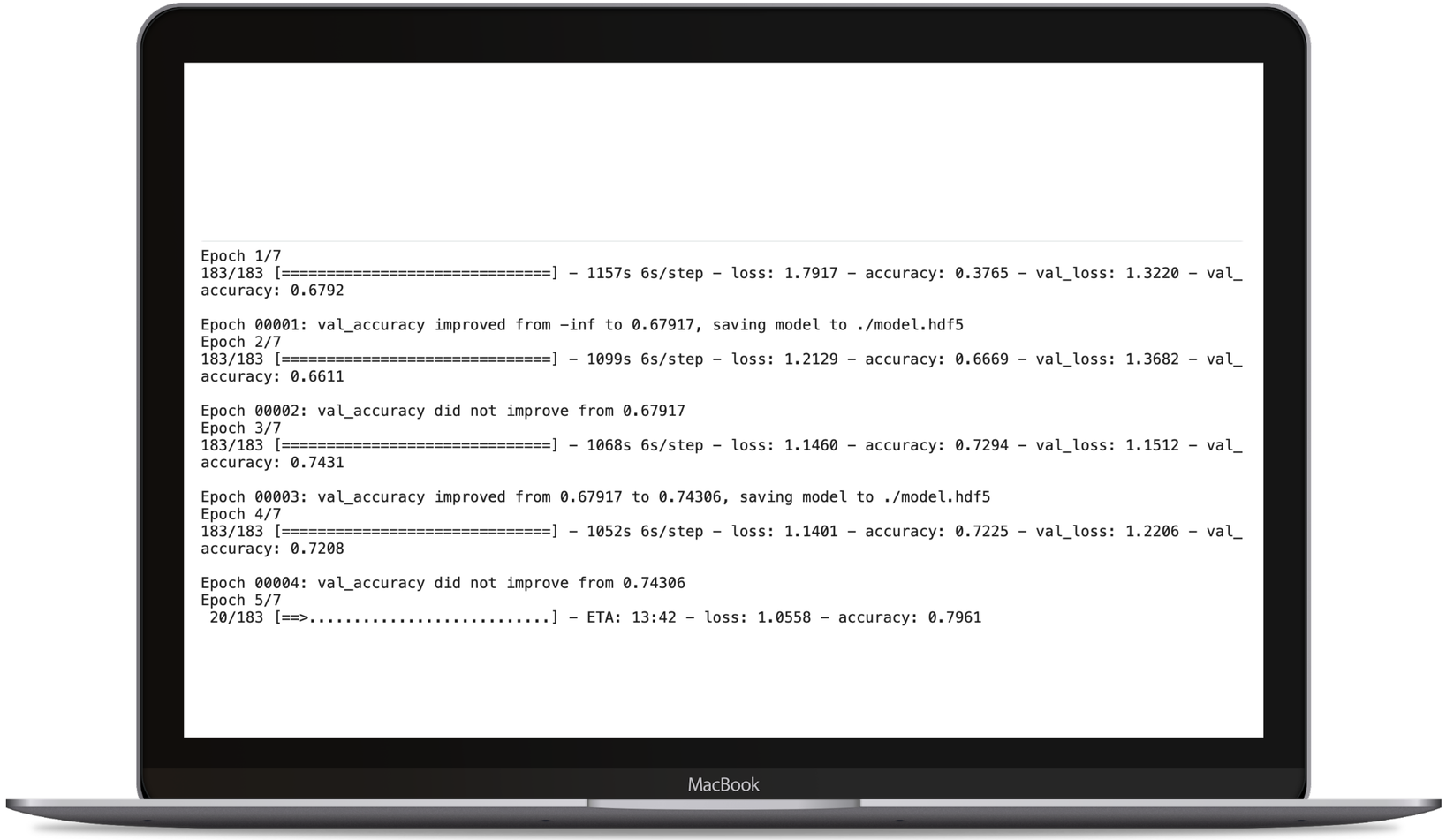
Let’s see the code



Experts

Thank You!

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