

# Transformer

Automatic Coding from Discharge Summary

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# Agenda

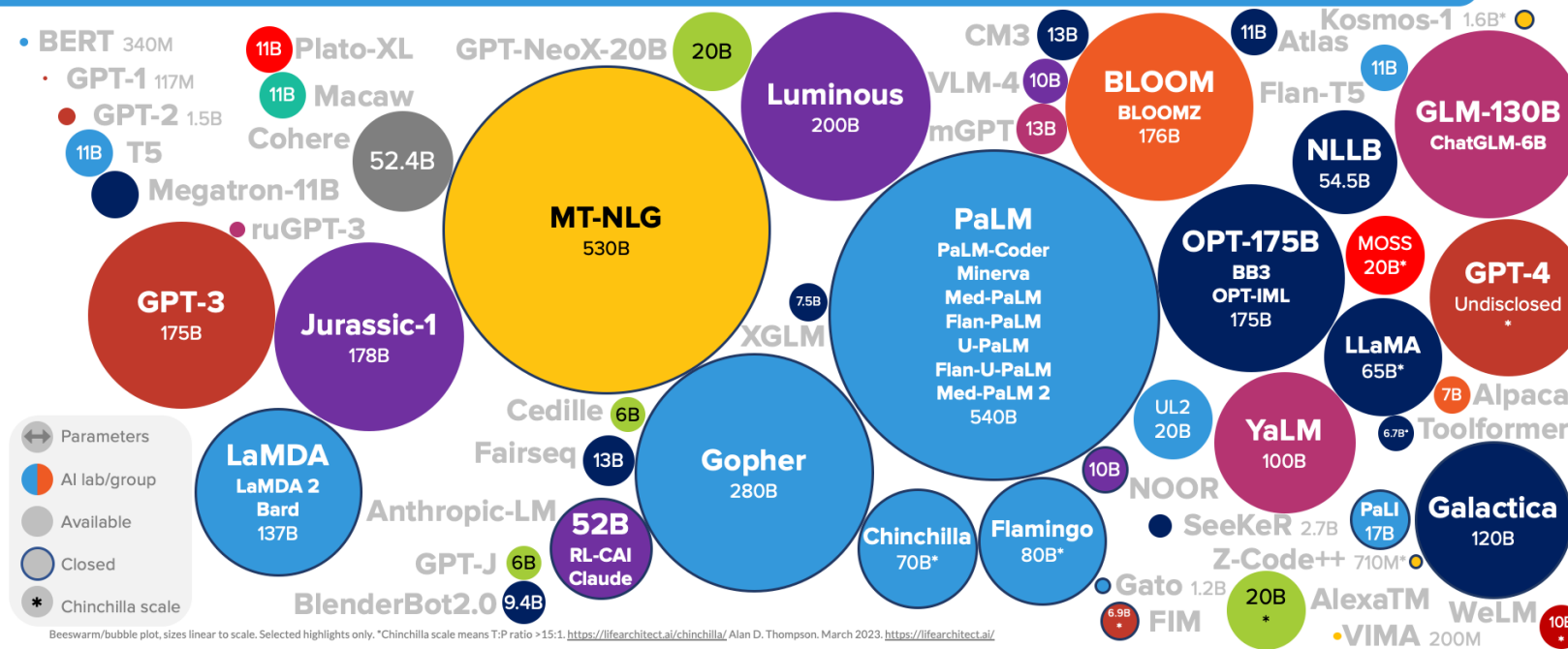
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1. Transformer
2. Discharge Summary



# Transformer

## LANGUAGE MODEL SIZES TO MAR/2023



LifeArchitect.ai/models

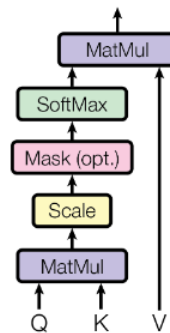


# Transformer

## Attention is All You Need (2017)

- Introduce Scaled Dot Product Attention
- Introduce Multi-Head Attention
- Introduce Transformer Architecture

Scaled Dot-Product Attention



Multi-Head Attention

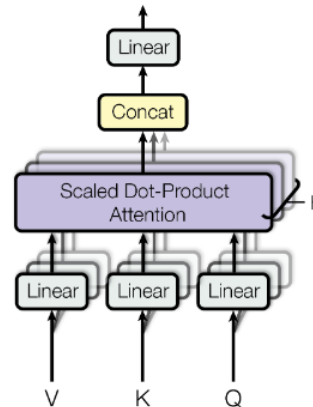


Figure 2: (left) Scaled Dot-Product Attention. (right) Multi-Head Attention consists of several attention layers running in parallel.

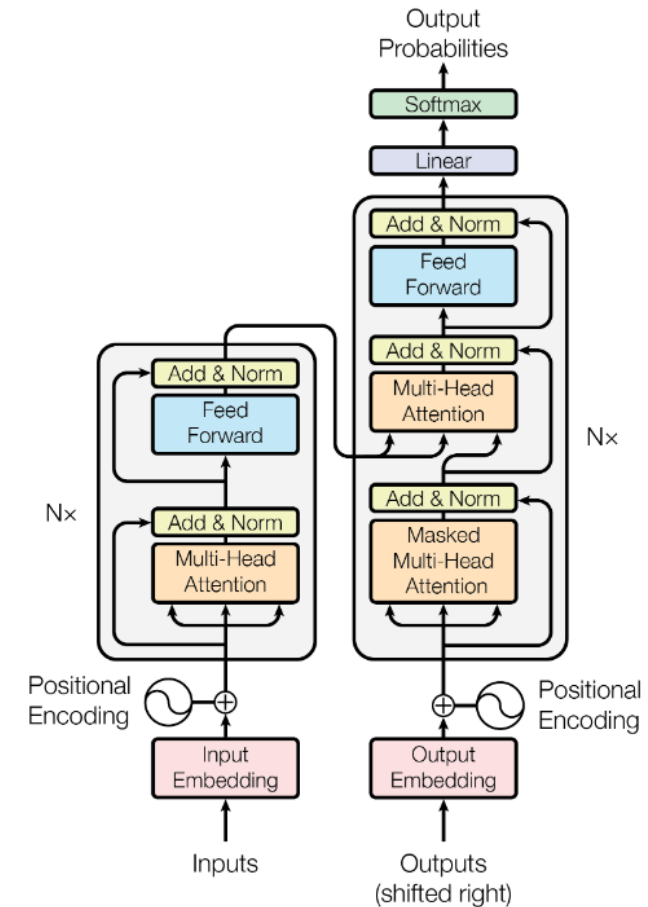


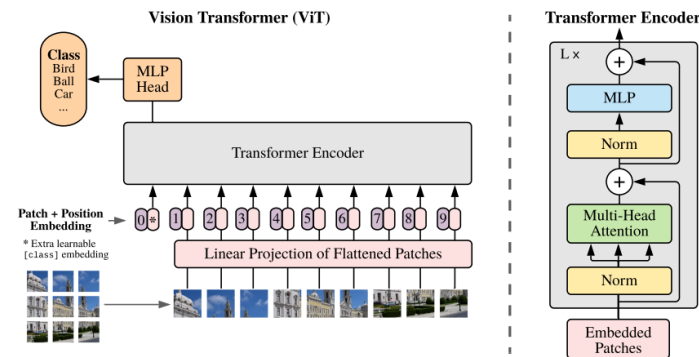
Figure 1: The Transformer - model architecture.



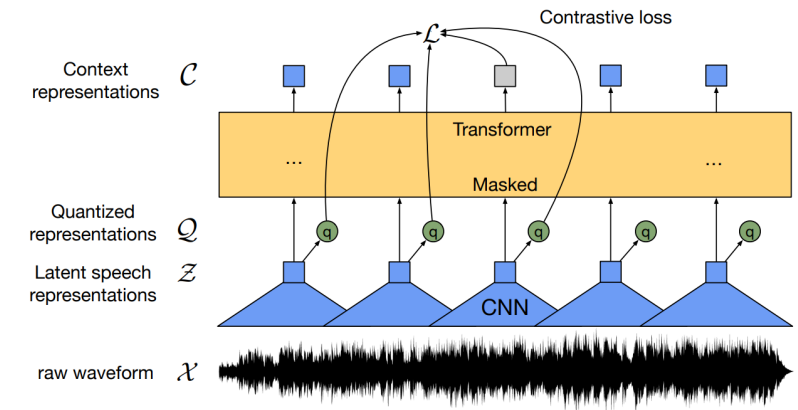
# Transformer



**Language Data**  
Language Modeling  
Chatting  
Question Answering



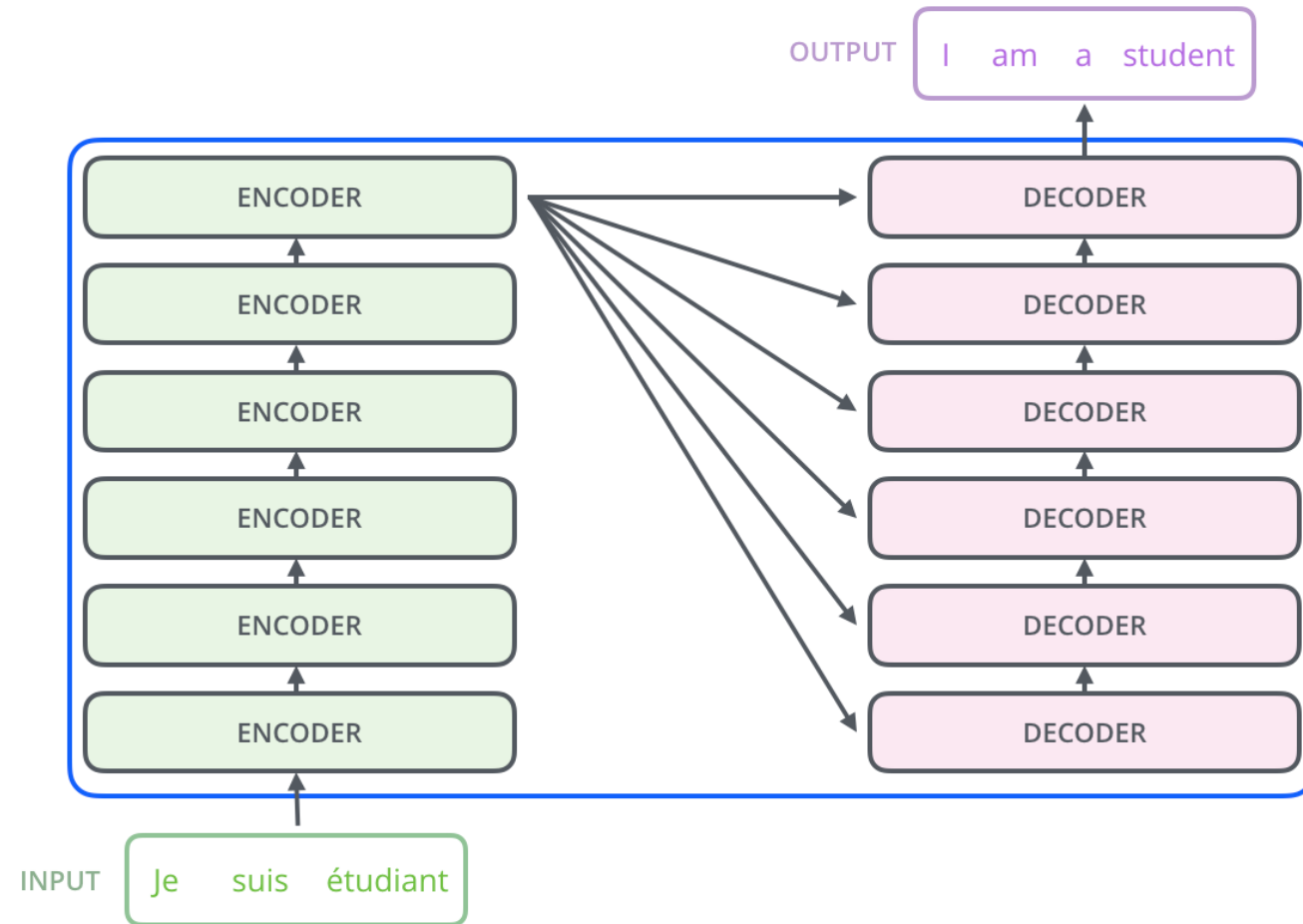
**Vision Data**  
Image Classification  
Object Detection



**Time-Series Data**  
Speech Recognition  
Time-Series Prediction

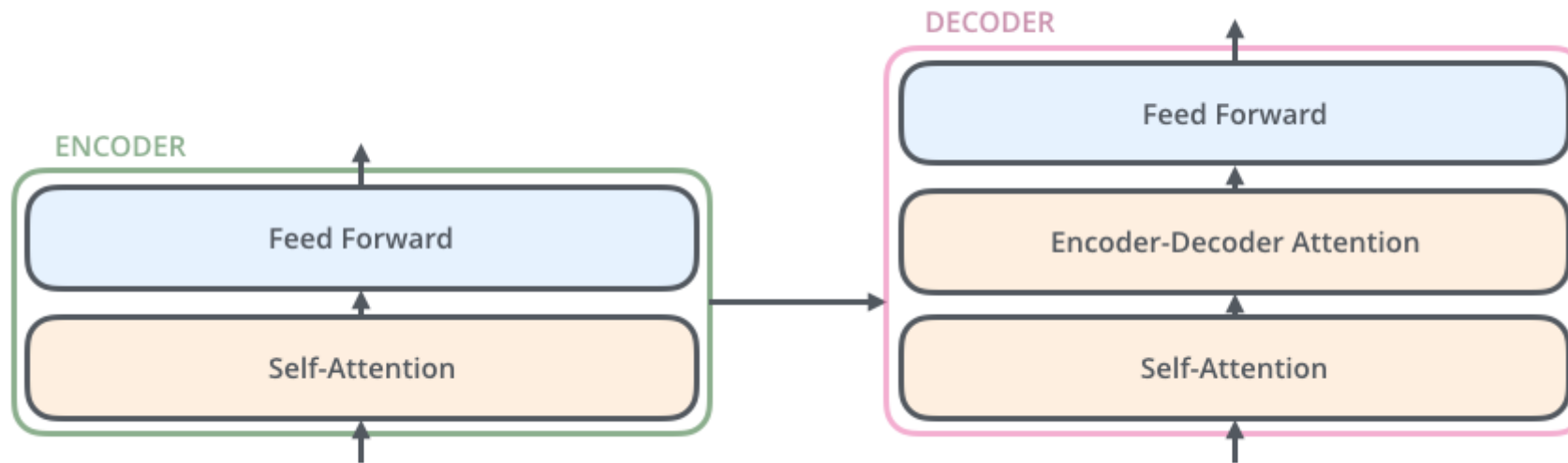


# Transformer



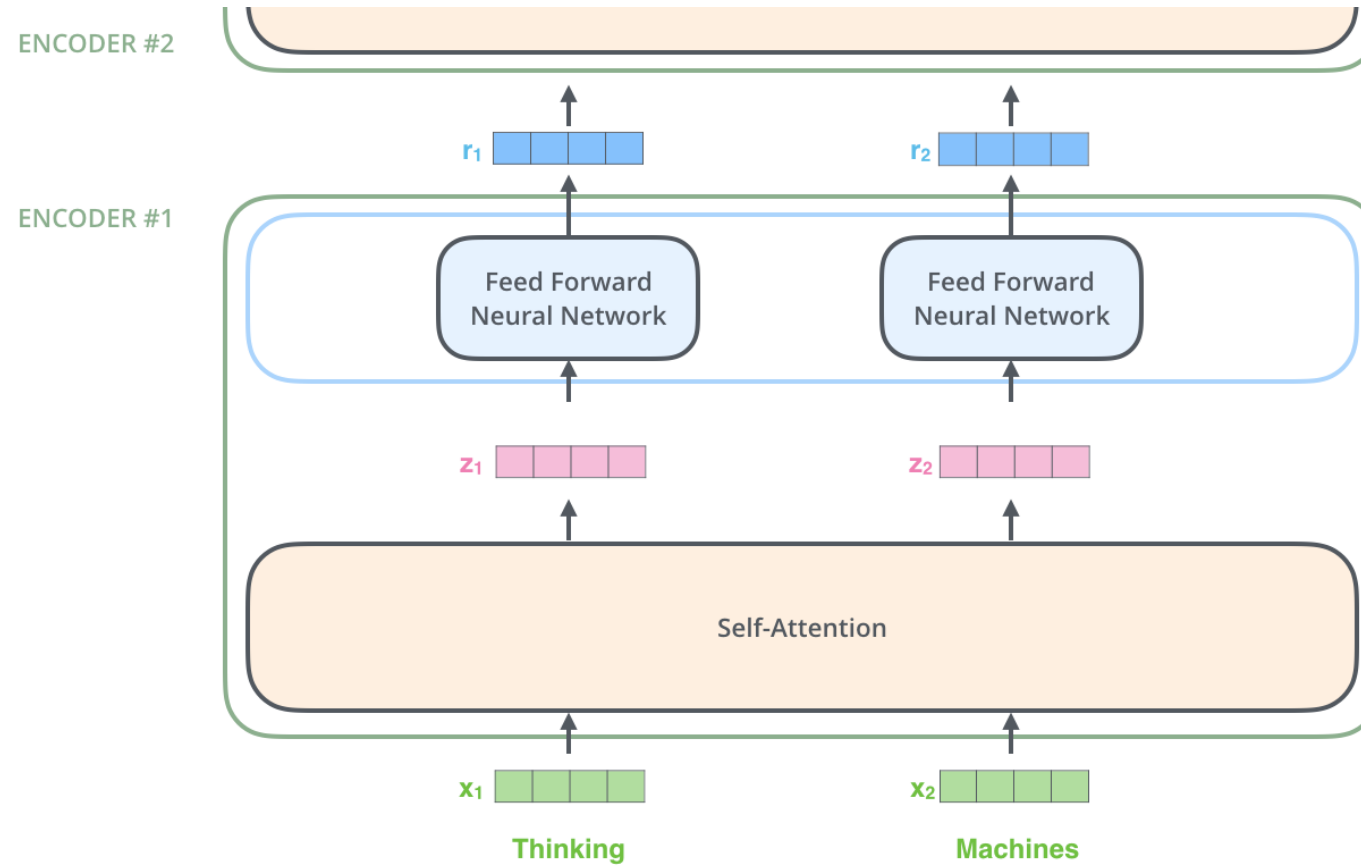


# Transformer





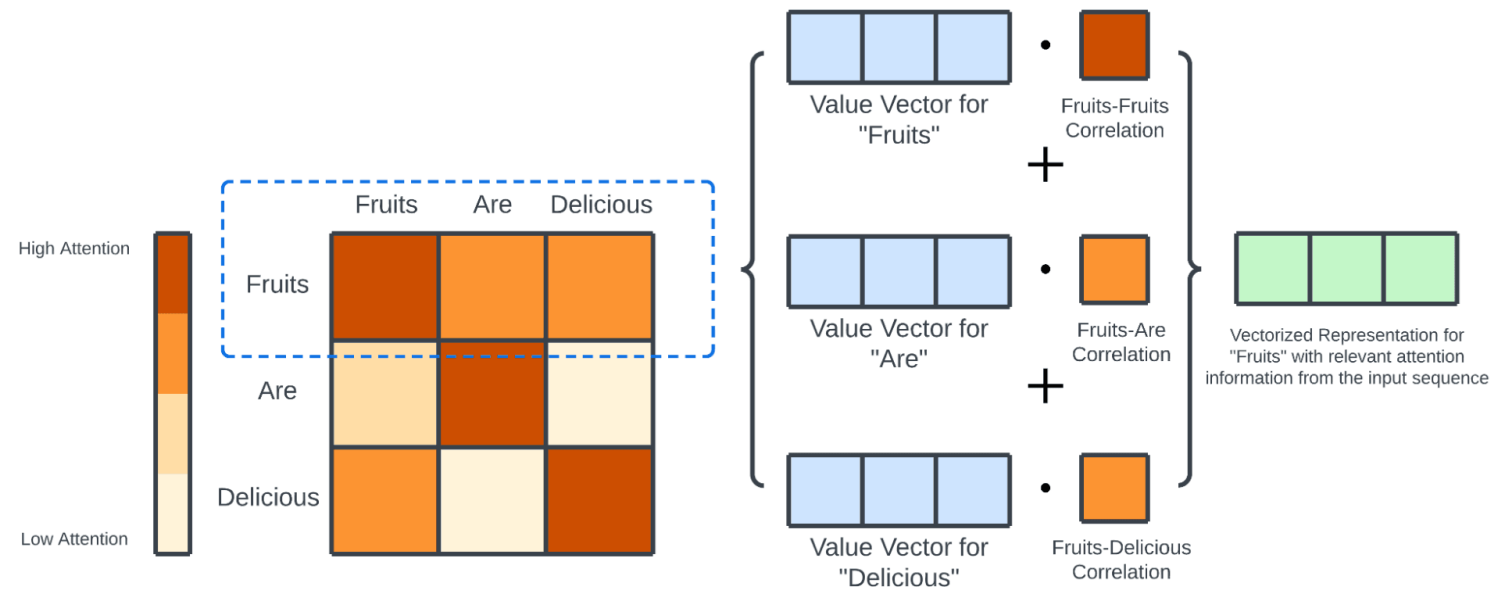
# Transformer





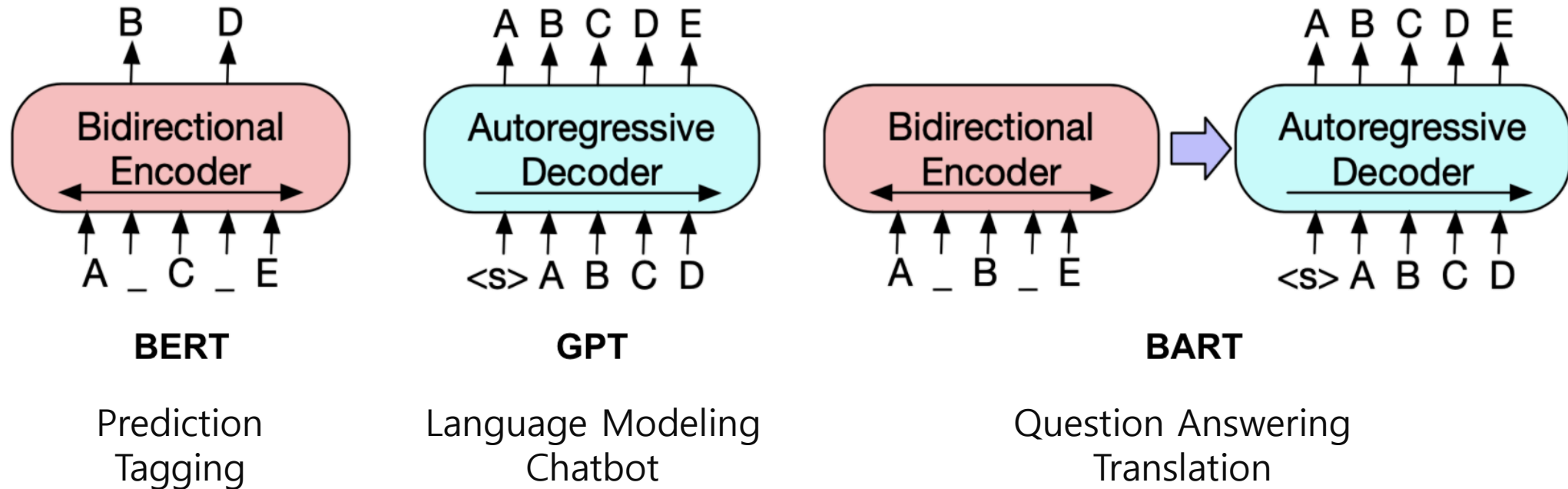


# Transformer





# Transformer



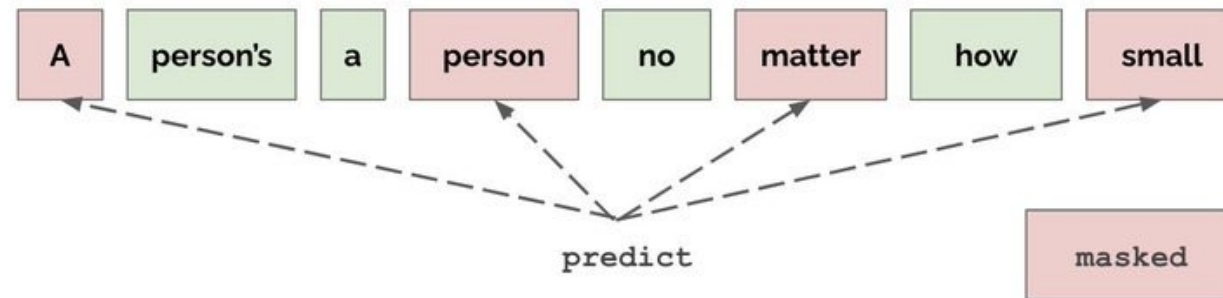


# Transformer

GPT - causal mask



BERT - random mask





# Discharge Summary

- A document prepared when a patient is discharged from the hospital.
- Free-text notes organized with structural headers
- Properties
  - Manually written by clinicians
    - Grammatical Errors
    - Medical Abbreviations
  - Include overall information of admission
    - Laboratory Measurements
    - Prescriptions
    - **Diagnosis**
    - Follow-up Care

**ADMITTING DIAGNOSIS:** Abscess with cellulitis, left foot.

**DISCHARGE DIAGNOSIS:** Status post I&D, left foot.

**PROCEDURES:** Incision and drainage, first metatarsal head, left foot with culture and sensitivity.

**HISTORY OF PRESENT ILLNESS:** The patient presented to Dr. X's office on 06/14/07 complaining of a painful left foot. The patient had been treated conservatively in office for approximately 5 days, but symptoms progressed with the need of incision and drainage being decided.

**MEDICATIONS:** Ancef IV.

**ALLERGIES:** ACCUTANE.

**SOCIAL HISTORY:** Denies smoking or drinking.

**PHYSICAL EXAMINATION:** Palpable pedal pulses noted bilaterally. Capillary refill time less than 3 seconds, digits 1 through 5 bilateral. Skin supple and intact with positive hair growth. Epicritic sensation intact bilateral. Muscle strength +5/5, dorsiflexors, plantar flexors, invertors, evertors. Left foot with erythema, edema, positive tenderness noted, left forefoot area.

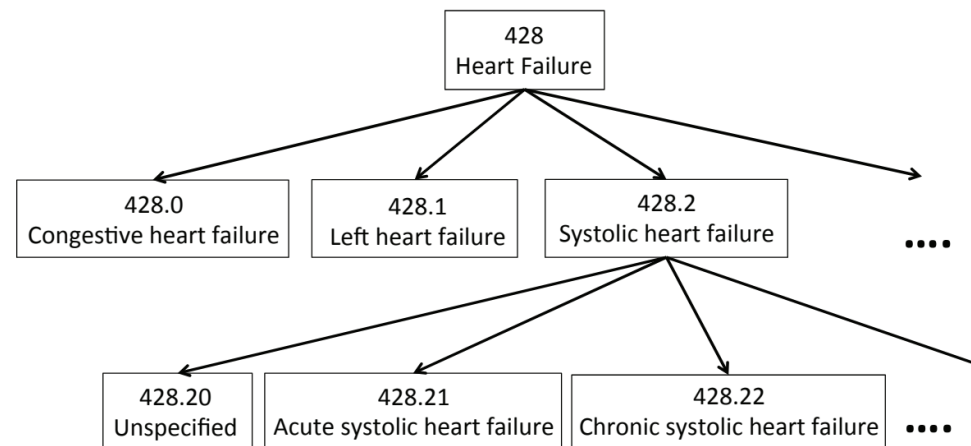
**LABORATORY:** White blood cell count never was abnormal. The remaining within normal limits. X-ray is negative for osteomyelitis. On 06/14/07, the patient was taken to the OR for incision and drainage of left foot abscess. The patient tolerated the procedure well and was admitted and placed on vancomycin 1 g q.12h after surgery and later changed Ancef 2 g IV every 8 hours. Postop wound care consists of Aquacel Ag and dry dressing to the surgical site everyday and the patient remains nonweightbearing on the left foot. The patient progressively improved with IV antibiotics and local wound care and was discharged from the hospital on 06/19/07 in excellent condition.

**DISCHARGE MEDICATIONS:** Lorcet 10/650 mg, dispense 24 tablets, one tablet to be taken by mouth q.6h as needed for pain. The patient was continued on Ancef 2 g IV via PICC line and home health administration of IV antibiotics.



# Discharge Summary- Automatic Clinical Coding

- Diagnosis details are typically recorded using some structured code system
  - ICD-9-CM
  - ICD-10
  - Snomed CT
- Automated Clinical Coding
  - Convert free text into structured codes
  - ex) Left Heart Failure -> 428.1





# Hands-on Session

