



PROGRESS PREDICTION

2°WEEK

Available data

Kaggle

- **CT Images at time 0 (baseline)**
- **Parameters through visits (not aligned between patients)**

MedGift

- **CT Images for visit x**
- **Parameters for visit x**

Parameters in common: sex, smoking status, age

Literature

Divided between Temporal data or Timestamp:

- **CT scans for each visit (w/o parameters)**
- **CT scan for visit x**

Most recent papers have focused their work on temporal data as it gives insight on the developed of diseases

INSIGHT ON TIMESTAMP DATA

1 Artificial Intelligence for prediction of COVID-19 progression using CT imaging and clinical data



2022

Methodology

- Pulmonary tissue and parnchymal abnormality from COVID-19



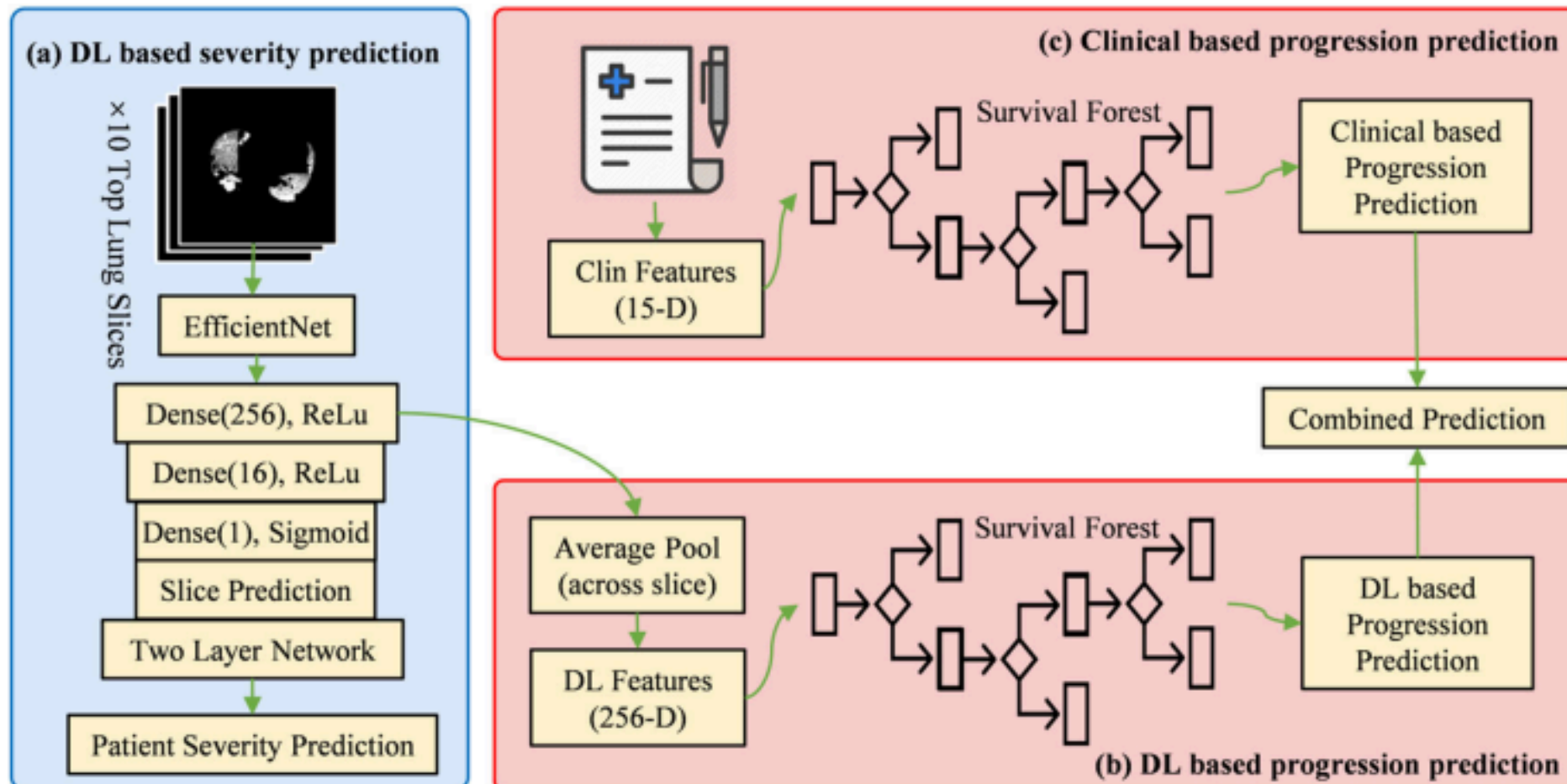
CNN (ENET)

- The top 10 segmented lung slices by largest area of pathology



EFFICIENTNET

Artificial Intelligence for prediction of COVID-19 progression using CT imaging and clinical data



Methodology

- **256D features pooled and passed to a Survival Forest to predict progression based on CT**
- **Clinical features (parameters) passed in another Survival Forest to predict progression**
- **Combined the two**

2 Multimodal Machine Learning based Knee Osteoarthritis Progression Prediction from Plain Radiographs and Clinical Data

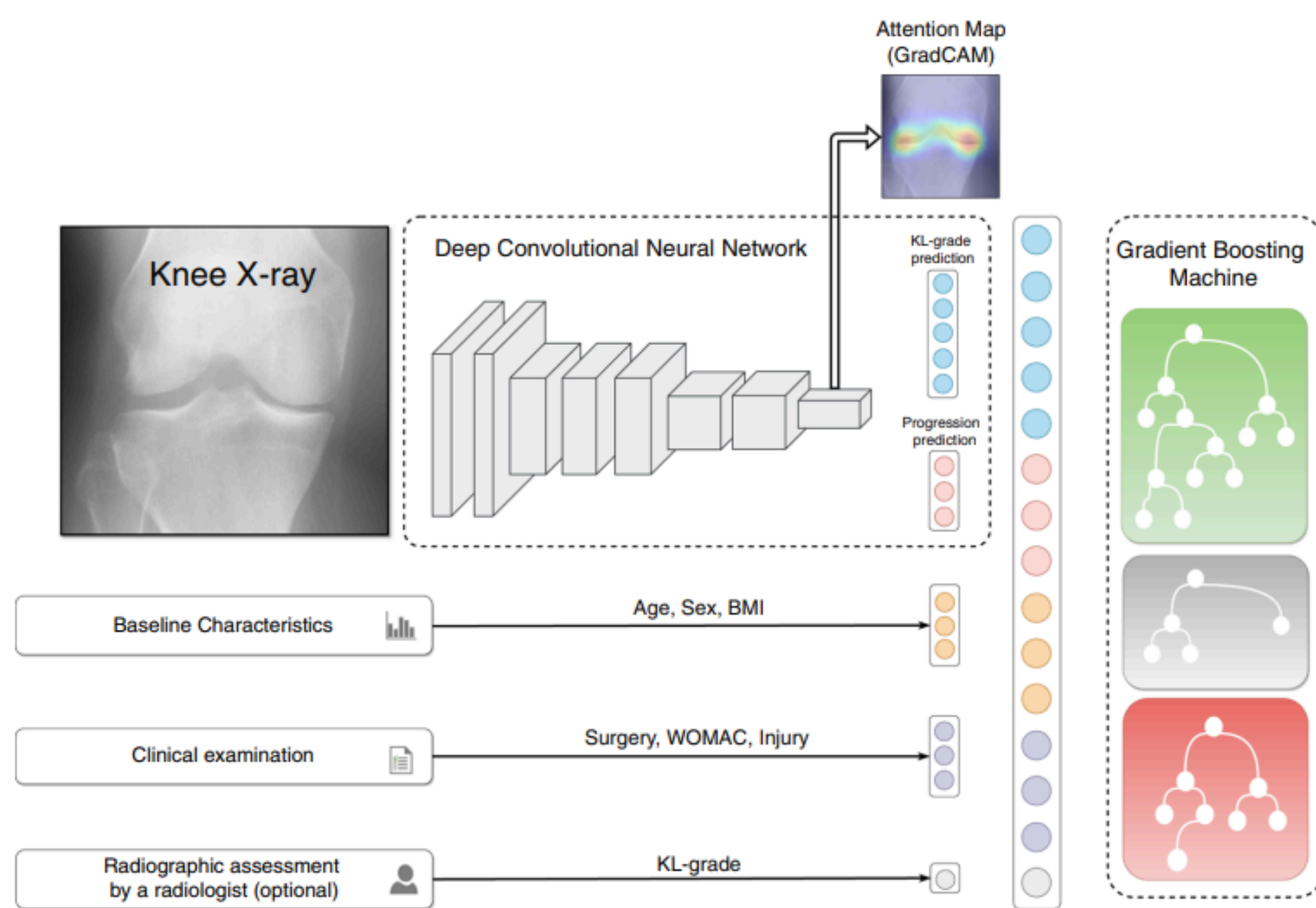
—————→ **2019**

Methodology

- **Predict probability of OA progression and KL grade**
- **Fuse the predictions with parameters**

—————→ **CNN (RESNEXT50)**

—————→ **GRADIENT BOOSTING MACHINE
CLASSIFIER**



WHAT IS A GBM?

Ensemble method that builds a series of decision trees, each one correcting the errors of the previous ones, and combines them into a strong predictive model.

3 Intelligent Image Processing Techniques for Cancer Progression Detection, Recognition and Prediction in Human Liver

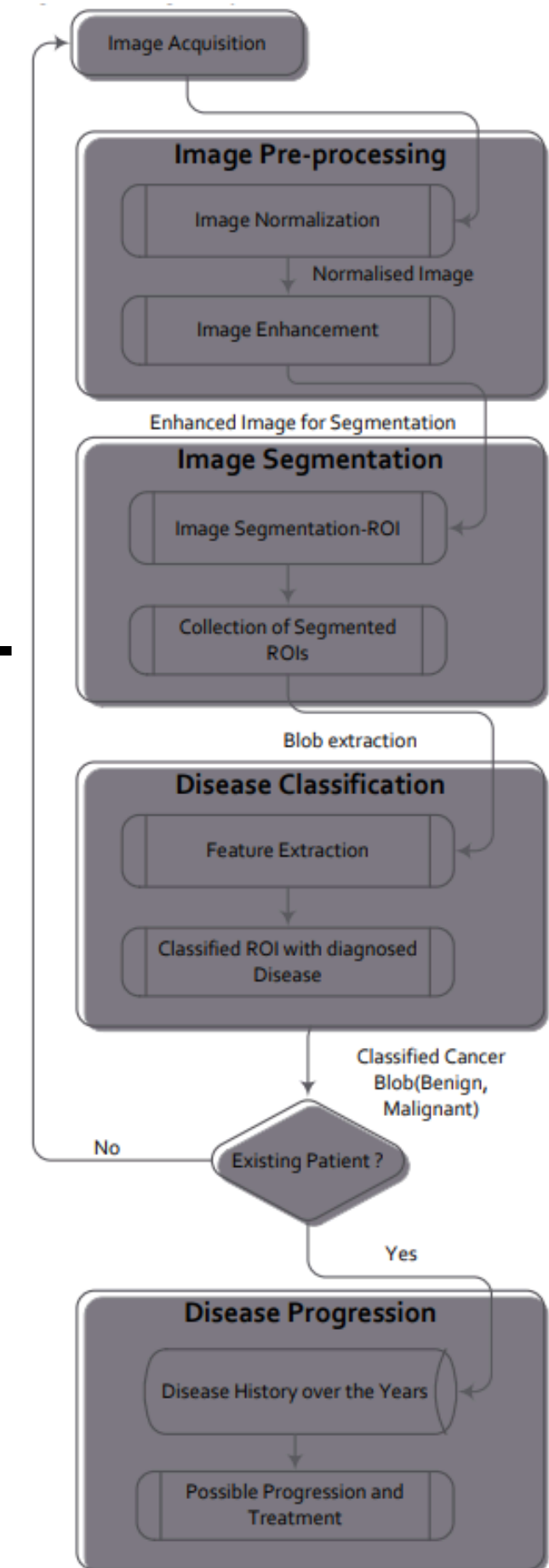
2014

Methodology

- Image segmentation, convert images to binary
- Extract features using Local Energy Based Shape Histogram
- Train classifiers for disease
- Compare image to next acquisition (needs temporal data)

ACTIVE CONTOUR MODEL

BEST SVM



INSIGHT ON TEMPORAL DATA

1 ImageFlowNet: Forecasting Multiscale Image-Level Trajectories of Disease Progression with Irregularly-Sampled Longitudinal Medical Images → **2025**

Methodology

- Input image at time t_i , extract multiscale feature maps → **UNET**
- Embedded in a joint latent space shared across patients
- Learn a flow field that shows how features move forward in time → **NEURAL ODES/SDES**

- **Determine new features**
- **New features passed through UNet decoder to develop the forecasted medical image**

NEURAL ODES/SDES



Models the rules of motion using a neural network, instead of discrete steps it uses continuous dynamics.
With SDEs, randomness is added, a noise term is added



2 DP-GAT: A Framework for Image-based Disease Progression Prediction



2022



Methodology

- **Segmentation (Region proposal)**
- **Process full image sequence (Region feature extraction)**

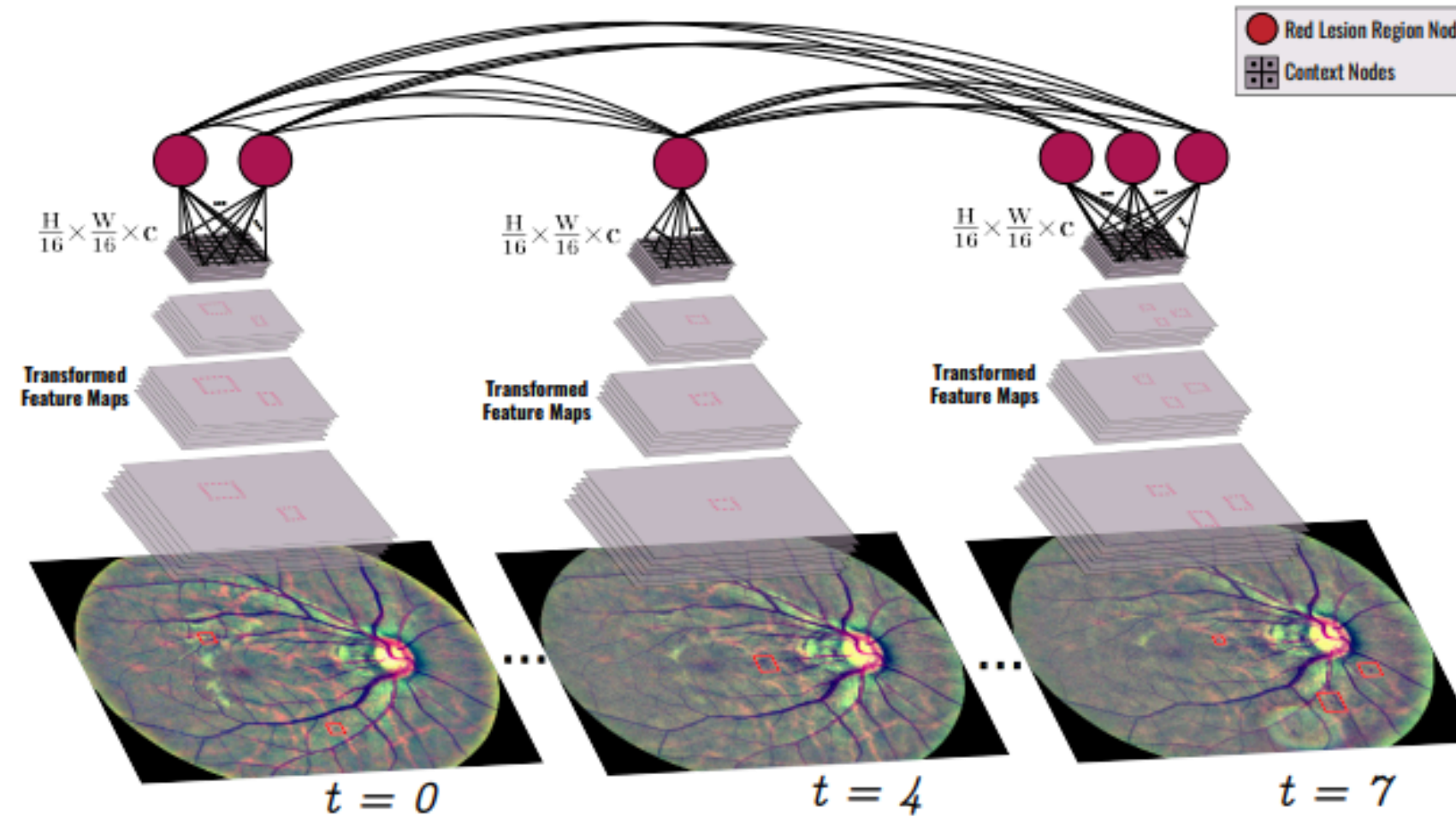


2D UNET



3D RESNET CNN

DP-GAT: A Framework for Image-based Disease Progression Prediction



- Graph reasoning (model relationships thorough time)
- Final vector passed through fully connected layer



GAT

OUR MODEL?

HYBRID MODEL

- **CNN for baseline image features**
- **Time series model for biomarker progression (LSTM/ODE/SDE)**
- **Fusion layer for final prediction (GBM?)**