*2019 AnoPCN: Video Anomaly Detection via Deep Predictive Coding Network*

AnoPCN has a deep recurrent architecture containing Predictive Coding Module (PCM) and Error Refinement Module (ERM). PCM is designed as a convolutional recurrent neural network with feedback connections carrying frame predictions and feedforward connections carrying prediction errors.

PCM is used in *k* consecutive previous frames , ERM is used in .

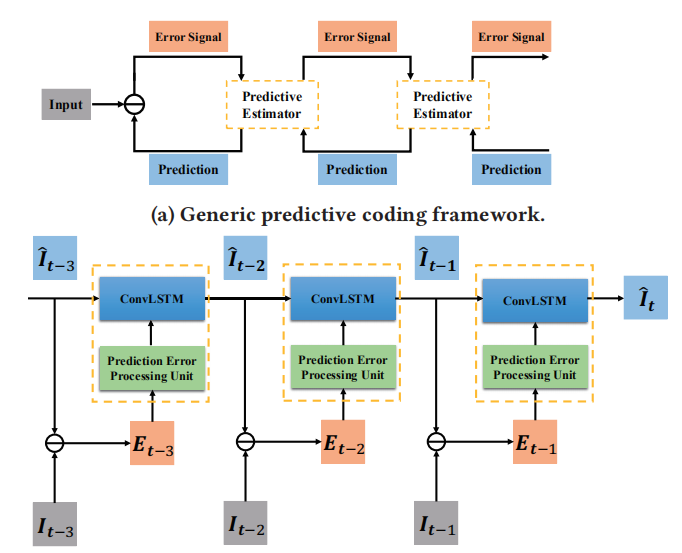
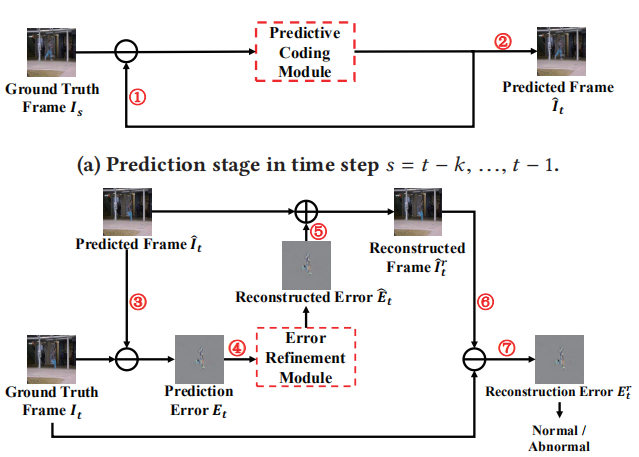
In the predictive stage, only PCM is used, in the refinement stage, only ERM is used.

PCM generates a predicted frame, ERM takes as input the current prediction error from PCM and feed it into U-Net to reconstruct the prediction error. First, PCM generates a prediction frame from previous frames. Next, ERM reconstructs the prediction error and adds a refinement to to obtain a reconstructed frame .

PCM consists of ConvLSTM, Conv Unit and Prediction Error Processing (PEP: U-Net) Unit.

In previous k frames, ConvLSTM generates a prediction frame which will be used to obtain the prediction error . PEP is to encode the prediction error and feeds it into ConvLSTM to update its internal states .

The architecture of ERM is quite similar to the PEP structure. ERM doesn’t have the last layer.



Narrow regularity score gaps between normal frames and abnormal ones:

Where is the regularity score of frame *t*. *N* and *A* are the sequence number sets of normal frames and abnormal ones. and are the total numbers of normal frames and abnormal ones.

To solve the problem of narrow , they propose a new strategy for reconstruction models by decomposing reconstruction into prediction and refinement.

They take the normalize Peak Signal-to-Noise Ratio (PSNR) of as the regularity score of video frame . PSNR of video frame in time step *t*:

Where is the maximum value of image intensity elements, and *P* is the total number of pixels in .

The lower is more likely contains anomaly. Normalized is exploited to quantify the regularity of frame :

Frame is abnormal or not can be judged by if is smaller than a given threshold. can be used to quantify the ability of discriminating anomaly and regularity for VAD techniques.