# A Computational Model for Top Down Visual Attention

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# Motivation

- Attention involves selectively processing certain aspects of the environment while ignoring others.
- Crucial for real time processing of stimuli
- Two aspects of visual attention
  - Bottom up
  - Top Down
- Top down is more dominant when the attention is goal oriented

# The approach

- Sequential nature of task driven attention
- The idea is to exploit this aspect to construct a model which predicts the current state based on the previous state and the features generated in the current state
- Compare this model with other classifier-based models

# Experiment

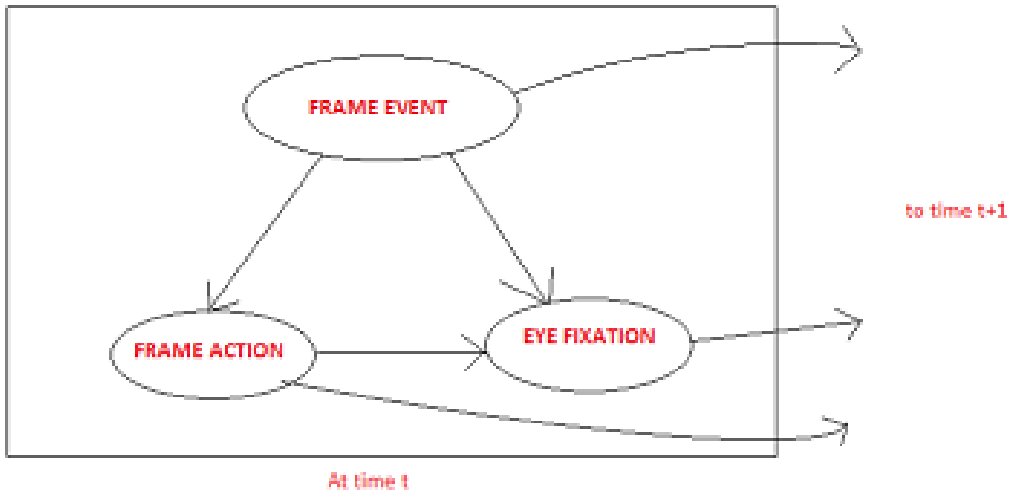
- Obtain data from a dynamic task : video games
  - 3D Driving School(player in motion)
  - Hot Dog Ambush(player static w.r.t environment)
- Identify features relevant to the task
  - GIST
  - Event in the video frame(for 3DDS)
  - Objects in the video frame(for HDB)
- Map features to the eye-gaze data for each frame to learn the mathematical model

# Experiment(cont..)

- The models:
  - Mean Eye Position
  - Random Eye Position
  - Regression
  - K Nearest Neighbours
  - Dynamic Bayesian Network

# Dynamic Bayesian Network

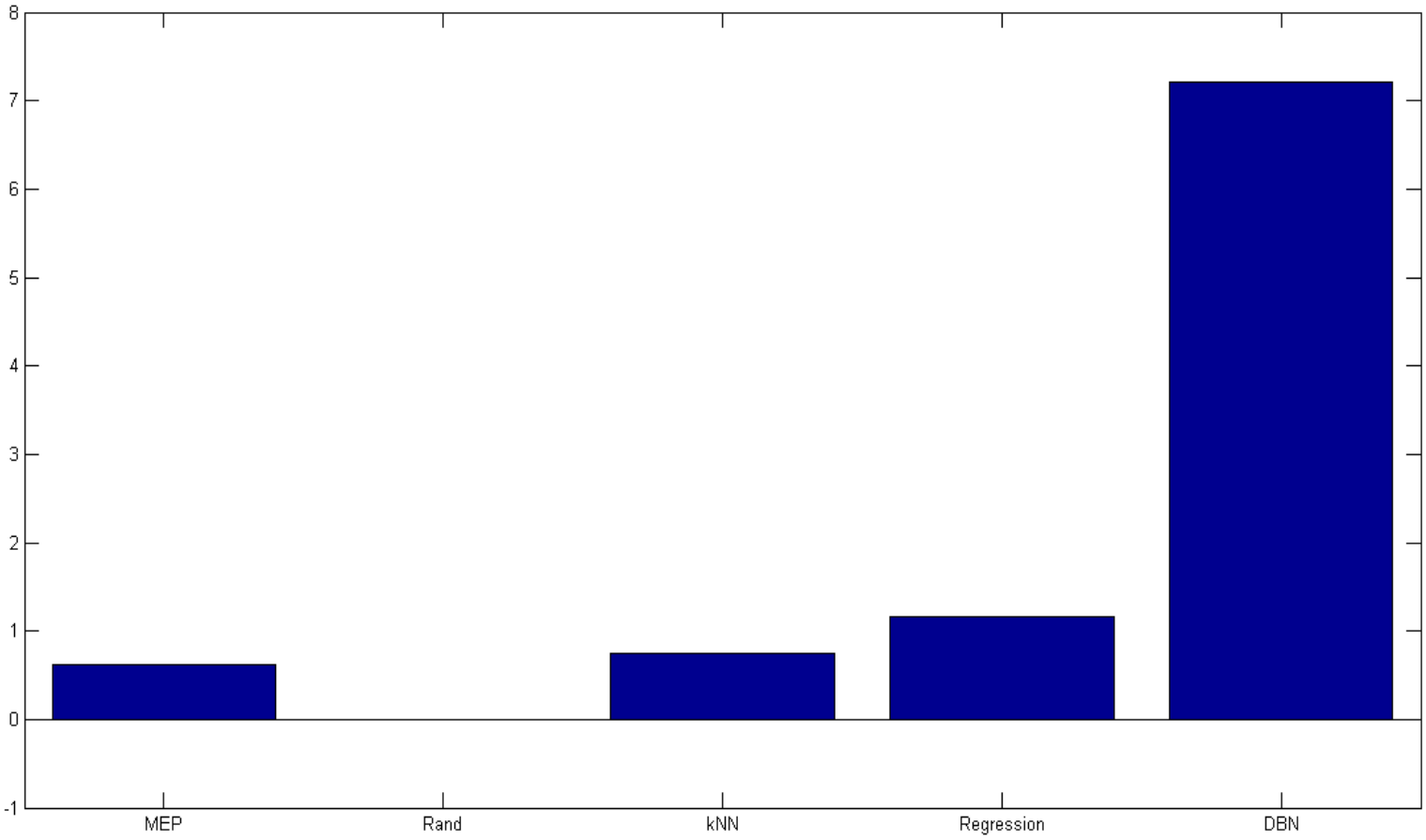
- *Two slice* Bayesian network




- Adjust m(structure of the DBN) and θ(transition matrix) to maximise P(E|m;θ)

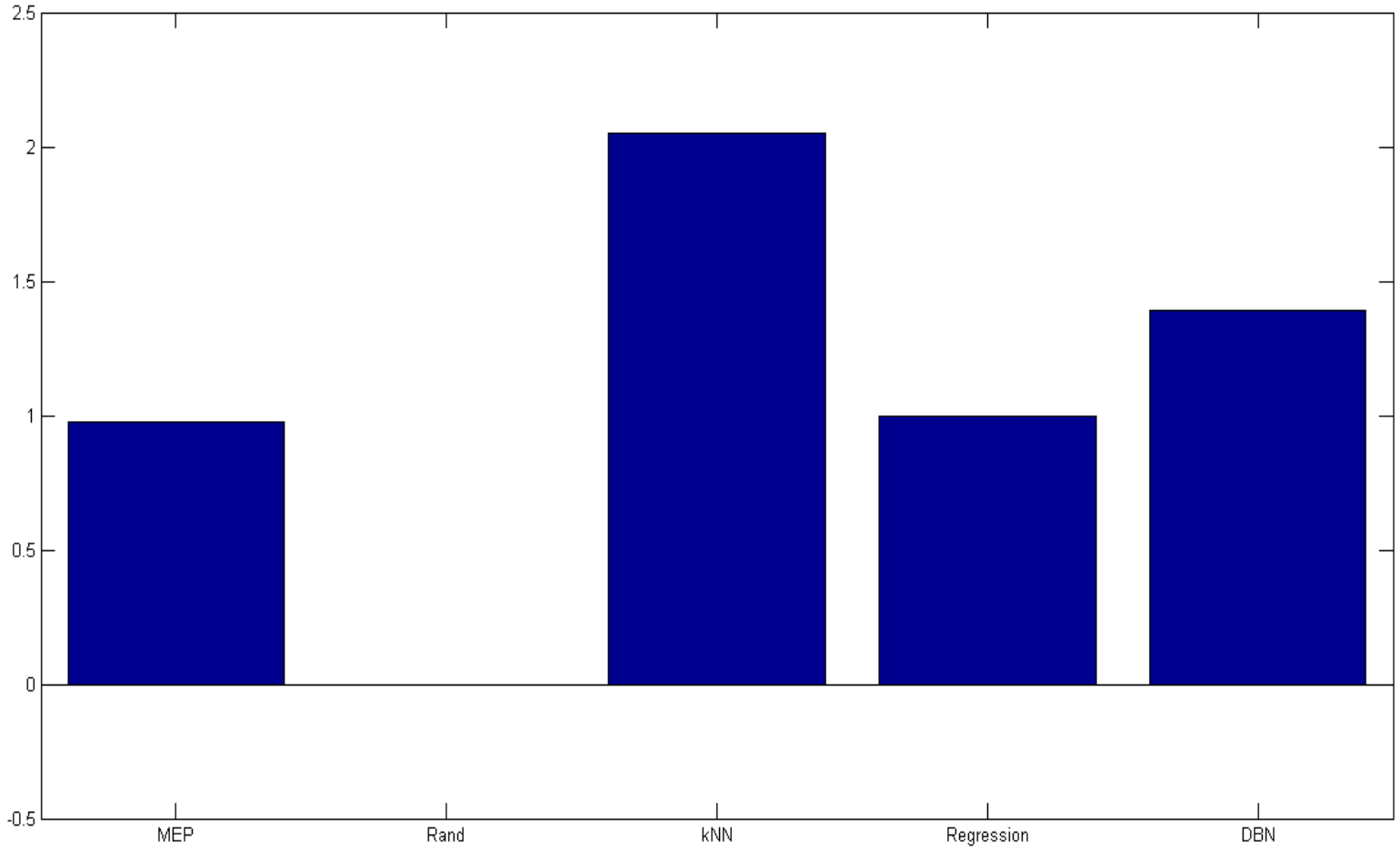
# Results(NSS)

- 3DDS



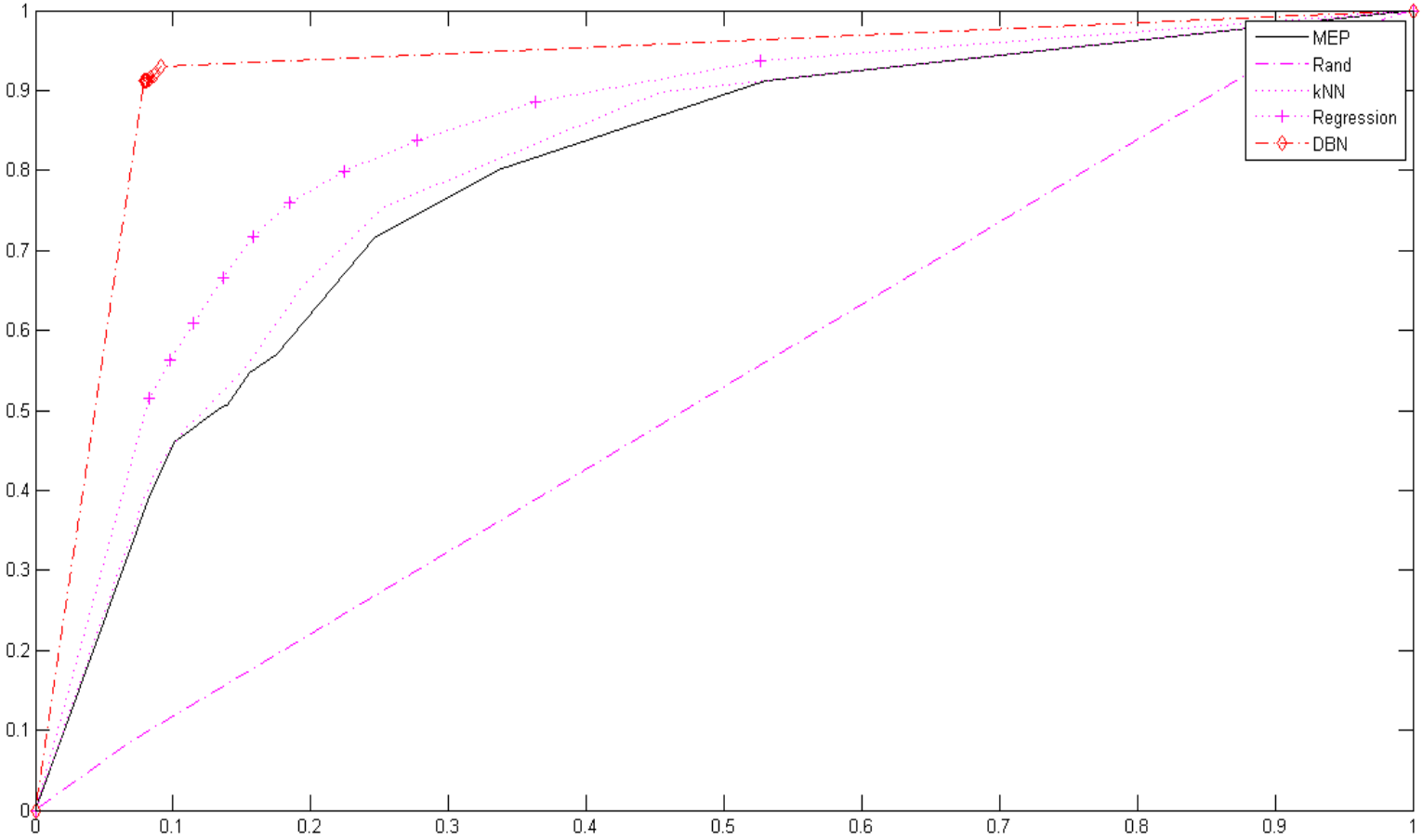
# Results(NSS)

- HDB



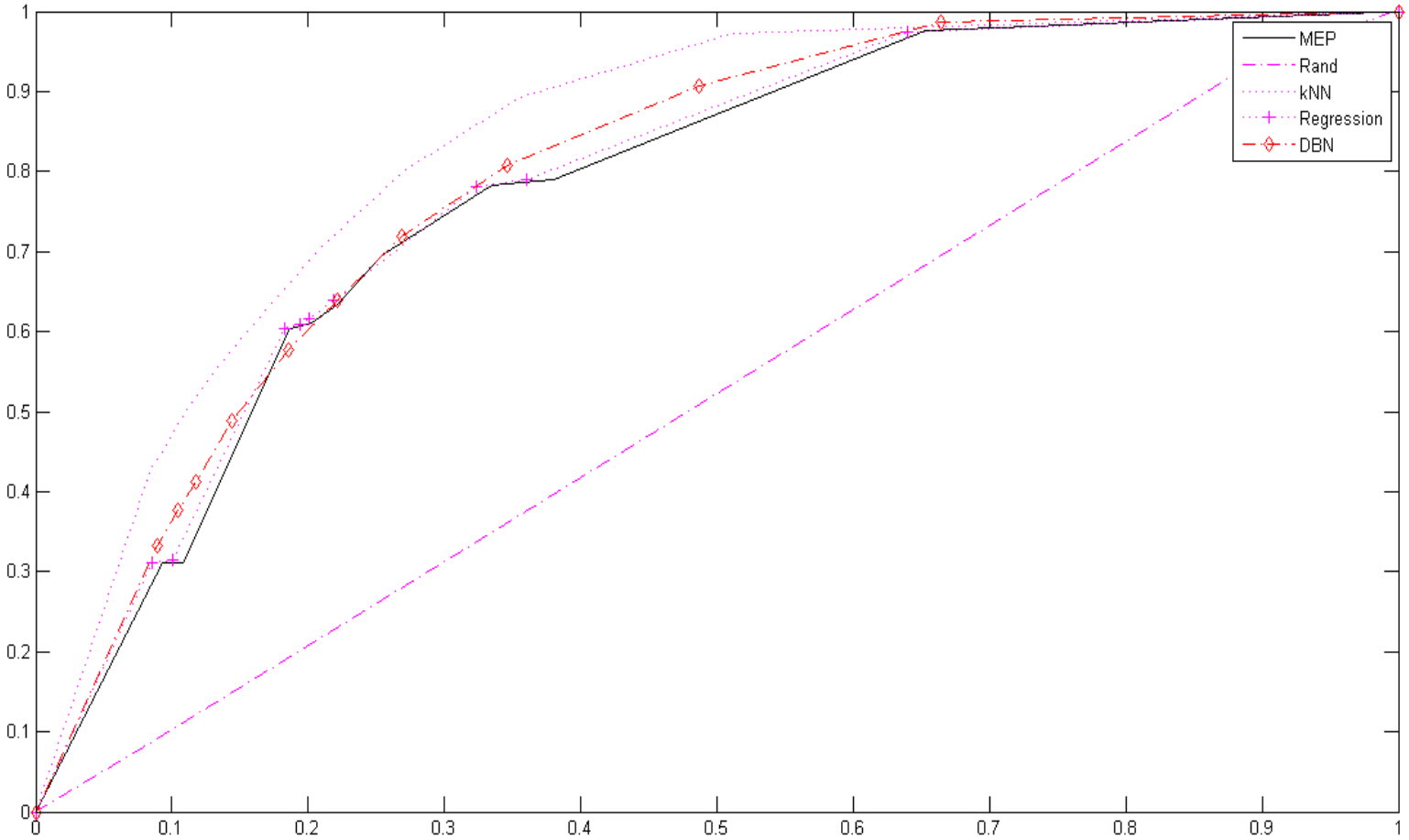
# Results(ROC)

- 3DDS

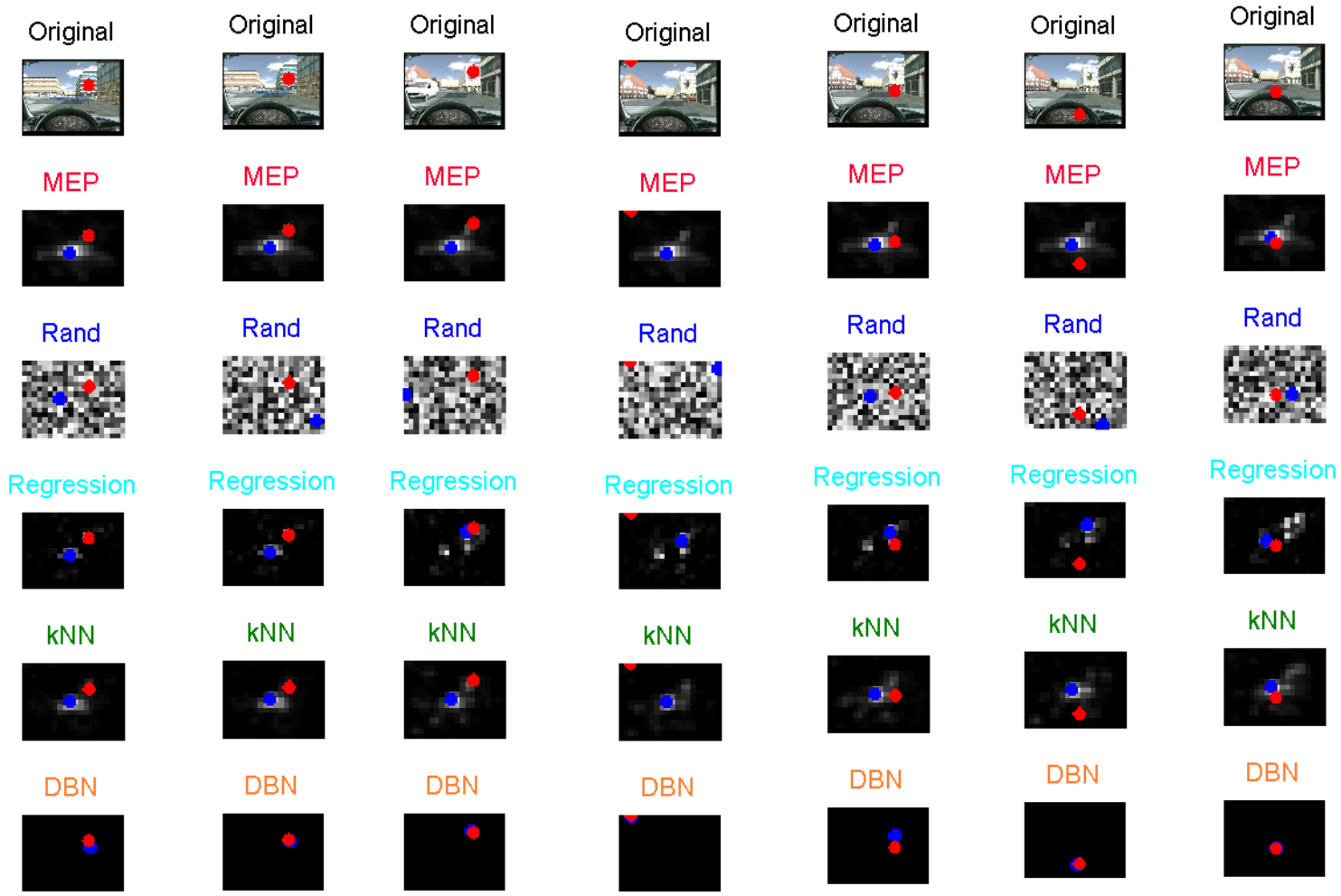


# Results(ROC)

- HDB



# Comparison of fixation(3DDS)



# Further work

- The model right now predicts eye fixation only.
- Can it be extended to saccades as well?
- Are global scene features of any importance in the model?
- Does the addition of bottom-up saliency model make any improvements in the result?

# References


- Borji, Ali, Dicky N. Sihite, and Laurent Itti. "An Object-Based Bayesian Framework for Top-Down Visual Attention." Twenty-Sixth AAAI Conference on Artificial Intelligence. 2012.
- Borji, A., Dicky N. Sihite, and L. Itti. "Probabilistic learning of task-specific visual attention." Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on. IEEE, 2012.
- Peters, Robert J., and Laurent Itti. "Beyond bottom-up: Incorporating task-dependent influences into a computational model of spatial attention." Computer Vision and Pattern Recognition, 2007. CVPR'07. IEEE Conference on. IEEE, 2007.