Learning an Egocentric Basketball Ghosting Model using Wearable Cameras and Deep Convolutional Networks

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I. Introduction

❏ Prior Work:

• Prior ghosting models are trained on the tracking data that records players' (x,y) locations in the court [Le. at al 2017].


• There is an implicit assumption that future behavior of the players depends **only** on their (x,y) locations in the court.

• However, players typically make decisions based on what they see, which is not incorporated into these models.

II. Basketball from a First-Person Perspective

❏ Setup:

• An egocentric GoPro camera is placed on a player's head.

• It records what a player sees during a 1-on-1 game.

• Our goal is then to build a model that maps an egocentric visual signal to a plausible behavior sequence.
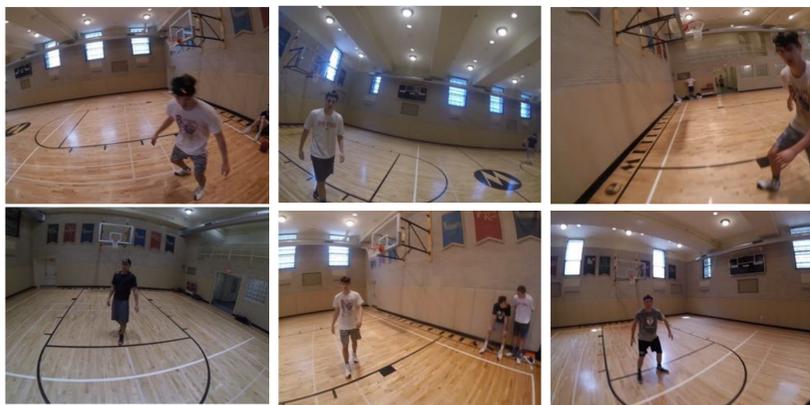
Egocentric Images Used as Inputs to Our System

III. Egocentric Basketball Ghosting Model

❏ Key Ideas:

• Our model consists of two CNNs: 1) a future CNN, and 2) an egocentric camera (EgoCam) CNN.

• EgoCam CNN predicts a 12D camera configuration encoding a player's 3D location and 3D head orientation.

• Future CNN predicts a set of 12D camera configurations capturing the future goals of real players.
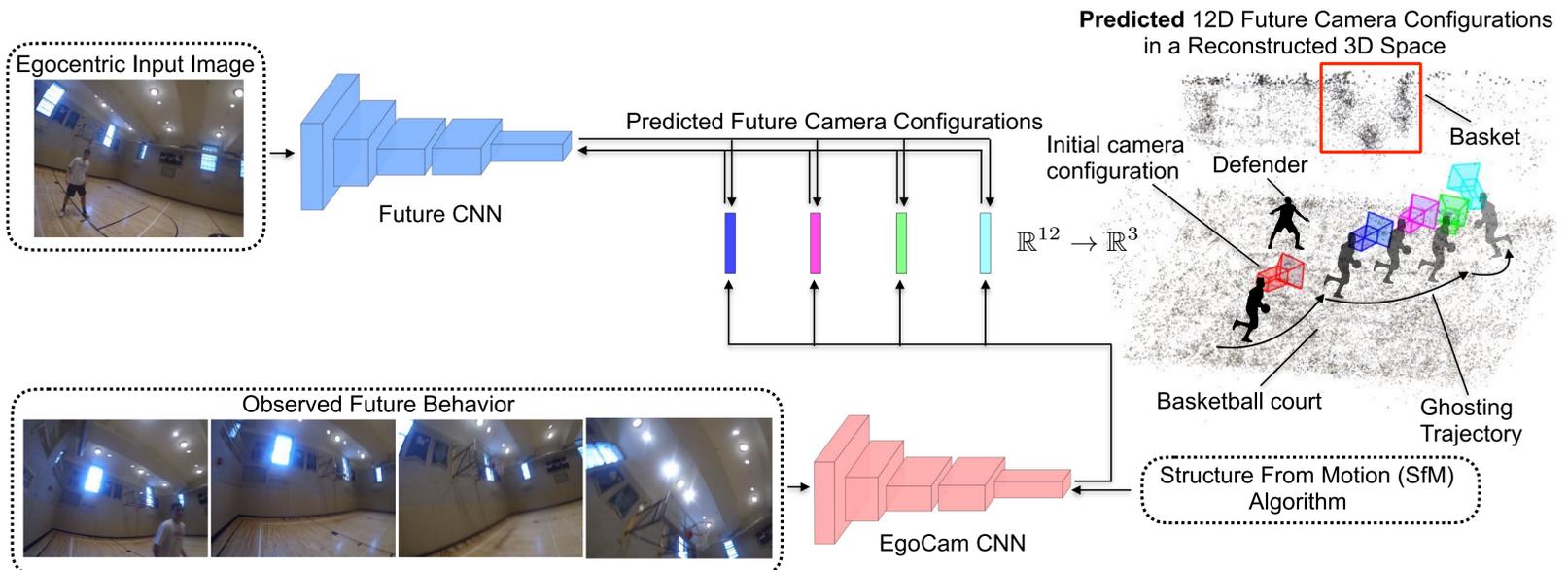
IV. Results

❏ Quantitative Results:

• We test each method on two tasks:

• Predicting a player's future behavior.

• Capturing the goals of real players.

• Our method consistently outperforms other baselines in both settings.

	Evaluation Tasks	
	PFB ↓	CG ↑
GAN [5]	62.31	0.329
RNN [9]	5.82	0.612
LSTM [7]	5.66	0.678
Ours	**4.92**	**0.719**

❏ Qualitative Results:

• The last column depicts our predicted ghosting trajectories.

• In columns 2,3 we also visualize neuron activations from the intermediate layers of our trained Future CNN.
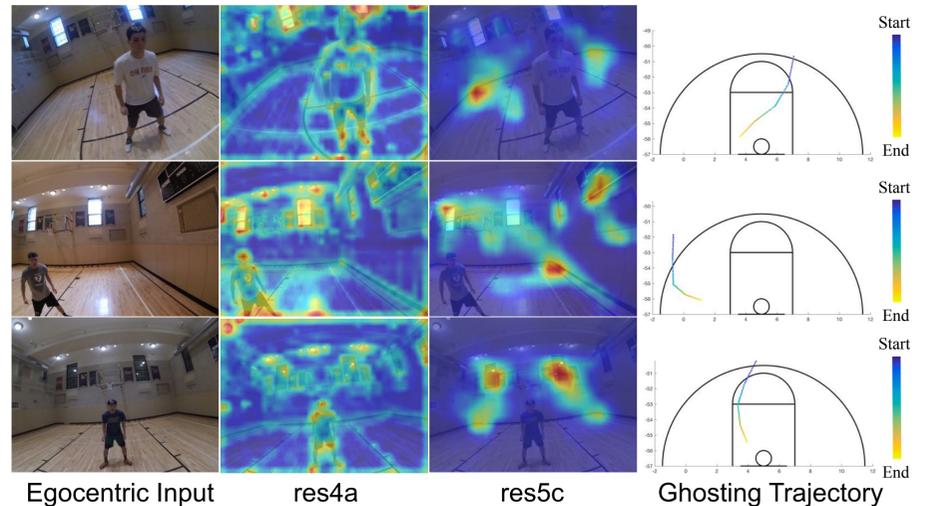
Egocentric Input   res4a   res5c   Ghosting Trajectory

• We also use a nearest neighbor algorithm to visualize our predictions in the form of egocentric images.

Egocentric Input   Branch 1   Branch 2   Branch 3   Branch 4

V. Conclusions

• We proposed an egocentric basketball model that generates realistic ghosting trajectories from a first-person image.

• Our model is learned in an unsupervised fashion, which is beneficial as obtaining labeled behavioral data is costly.

• We believe that our egocentric model could be used for many exciting applications such as player decision making analysis and player decision making improvement.