In the name of GOD the companionate the merciful

# 3 BACKGROUD

## 3.1 GAN

Generative adversarial network (GAN) are unsupervised deep neural architectures that capture input data distribution by predicting features from an initial latent space. The standard GAN consist of two sub-network namely Generator (G) and Discriminator (D).

The Theory behind this network is come from a competition of these sub-networks within a zero-sum game framework, as initially use in game theory. The generator aims to model the data distribution by mapping a random sample from latent space to data space. The generator up-sample the input arbitrary latent representation to generate high dimensional features as same as real data. In contrary, the task of the discriminator network is to distinguish that the input is originated from real data distribution or it is initiated from generator distribution.

These sub-networks compete in a Nash equilibrium where these will result to learn both generator and discriminator simultaneously. This adversarial learning process is formulated as a following zero-sum min-max game below [1].

Where PX(x) is the distribution of data x in data space X, and PZ(z) is the distribution over latent generator variable in the latent space Z. It proofs In [1] that this minimax game has a global optimum for Px = PG ; which means that the global minimum is obtained if and only if the generator distribution (PG) matches the true data distribution (Px).

Generative adversarial nets are trained via alternative gradient descent by concurrently updating the parameter of generative and discriminative distribution; so that it discriminates between samples from the data distribution Px from the generative distribution PG.

1 . I. Goodfellow, J. Pouget-Abadiey, M. Mirza, B. Xu, D. Warde-Farley,S. Ozairz, A. Courville & Y. Bengiox, "Generative Adversarial Nets," in NIPS, 2014.