



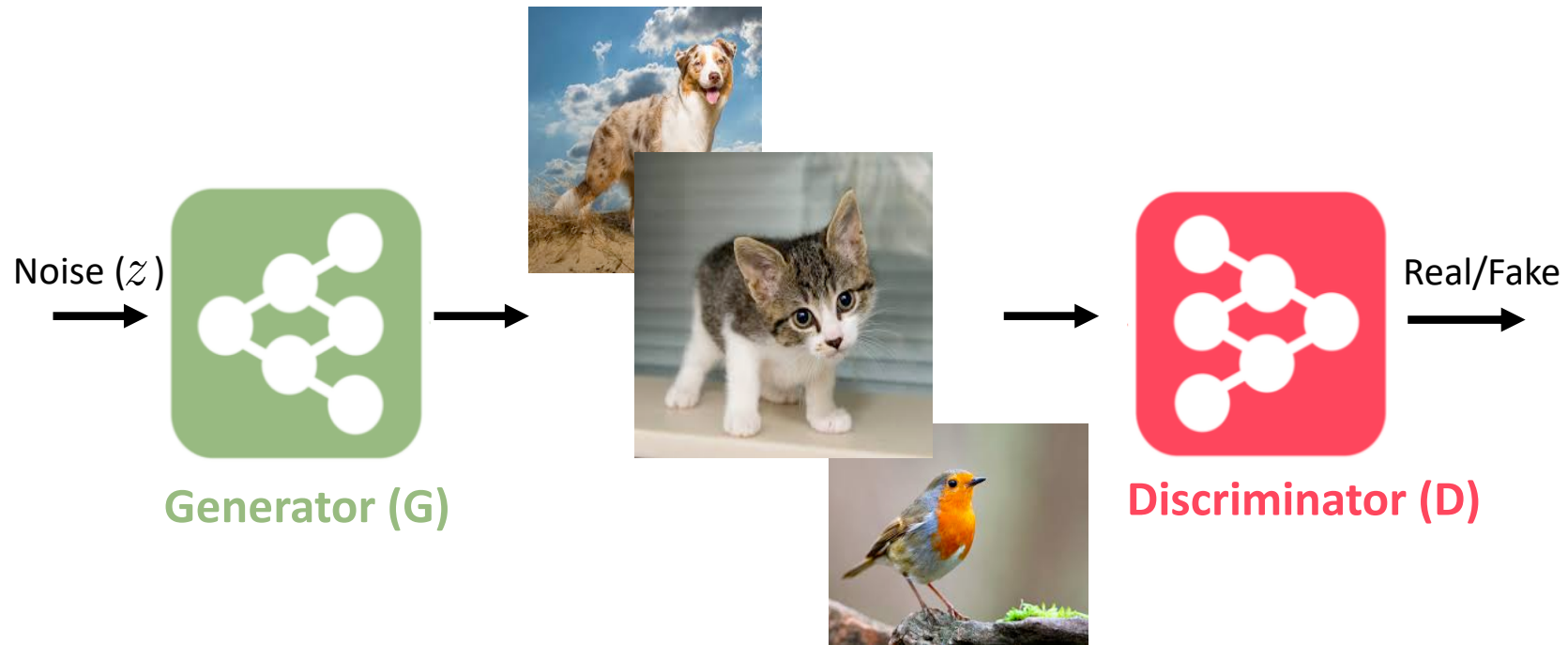
Twin Auxiliary Classifiers GAN (TAC-GAN)

Mingming Gong* Yanwu Xu* Chunyuan Li
Kun Zhang Kayhan Batmanghelich



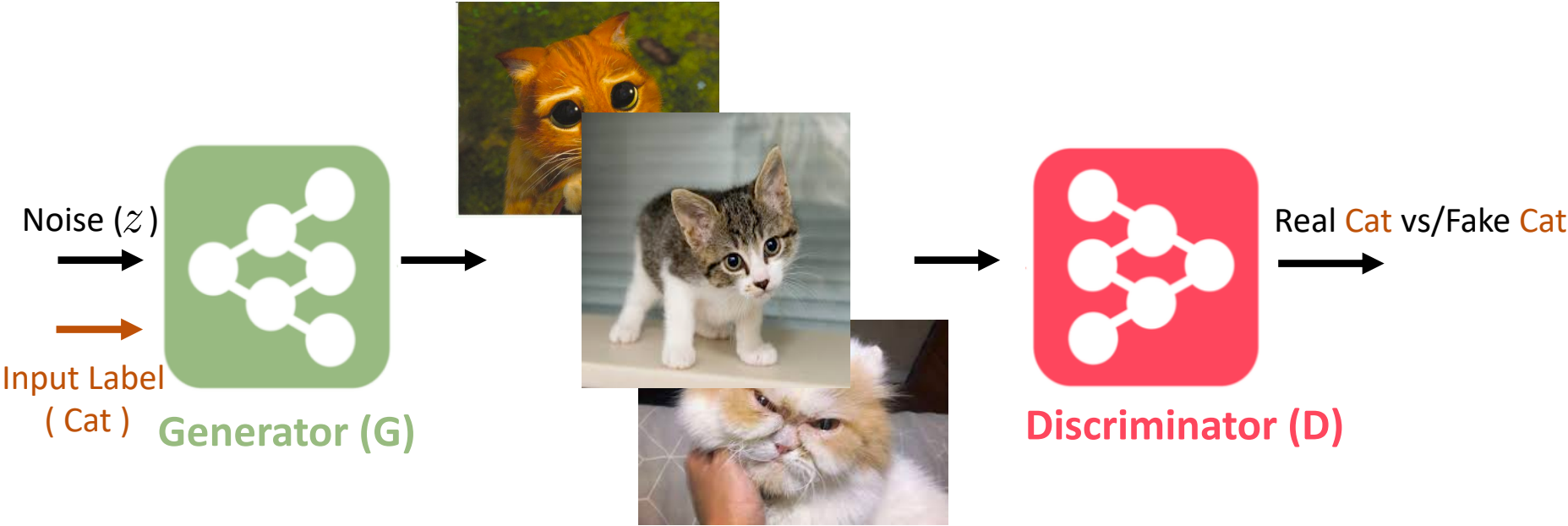
Microsoft®
Research

Generative adversarial networks(GAN)



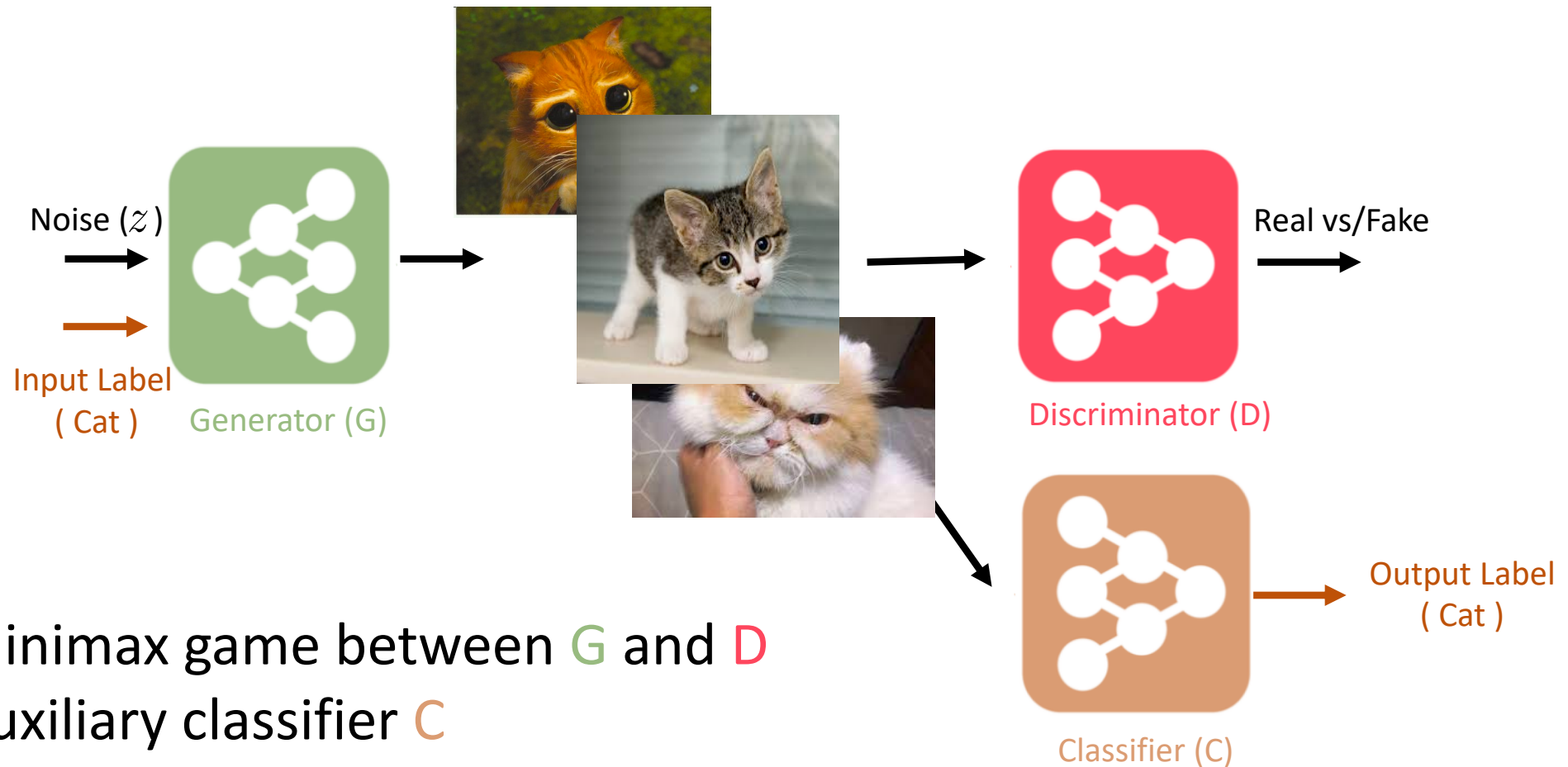
Minimax game between G and D

Conditional GAN(CGAN)



Minimax game between G and D

Auxiliary Classifier Conditional GAN(AC-GAN)



Issues with AC-GAN

Low diversity



CIFAR100

Tends toward mode collapse

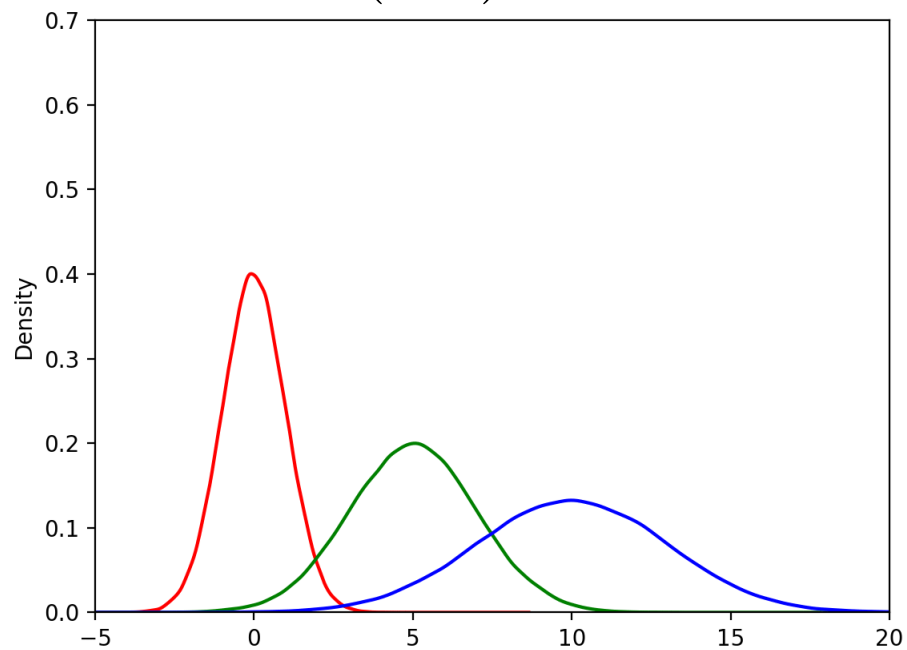


Imagenet1000

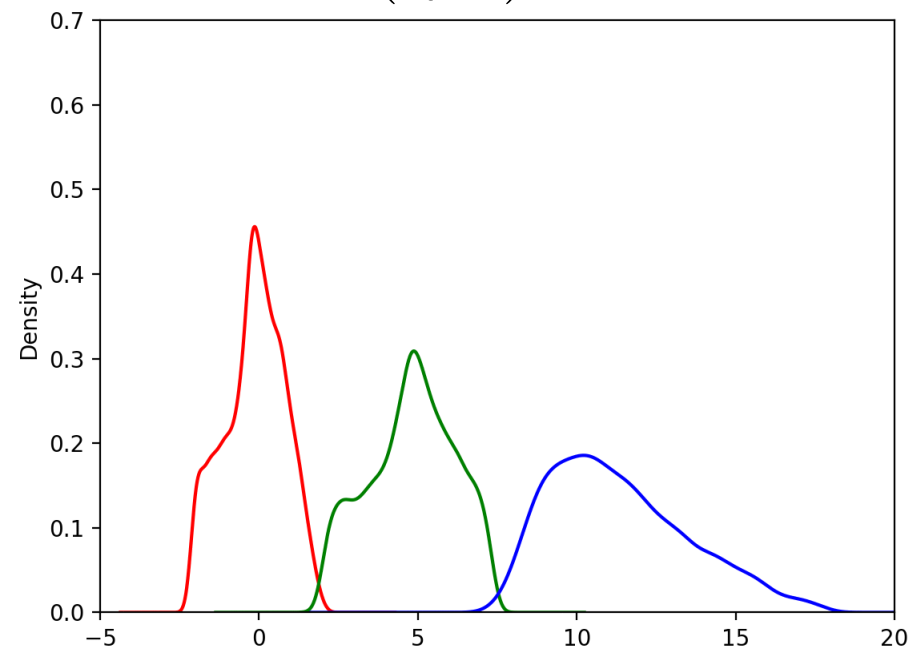
1D Mixture of Gaussian

- Class_0
- Class_1
- Class_2

True Distribution
(P_X)



Estimated Distribution by AC-GAN
(Q_X)



AC-GAN: Density Matching Point of View

P data distribution

Q estimated distribution

XY joint

Q_{XY}



P_{XY}



AC-GAN: Density Matching Point of View

P data

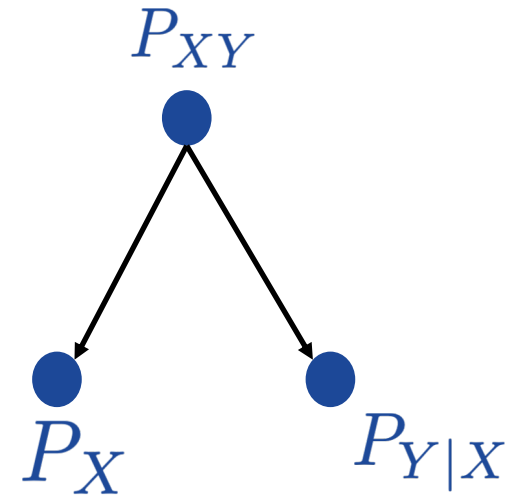
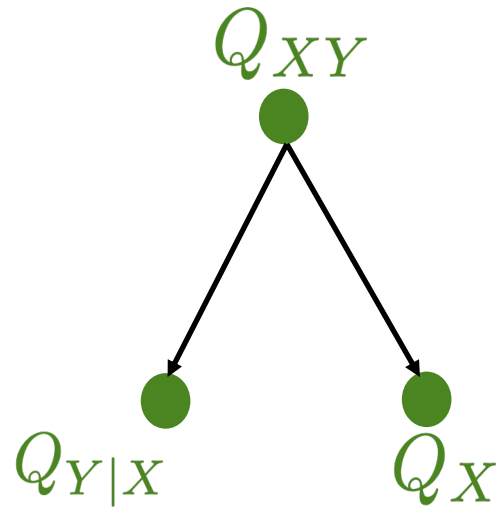
Q estimated

XY joint

X data

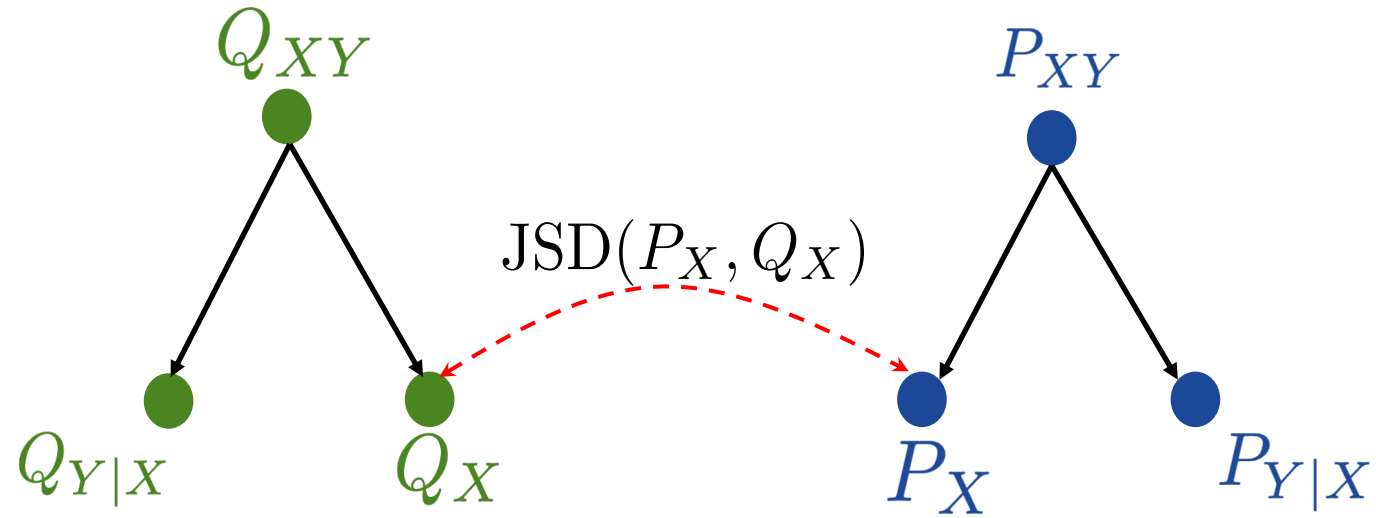
Y label

$Y|X$ conditional



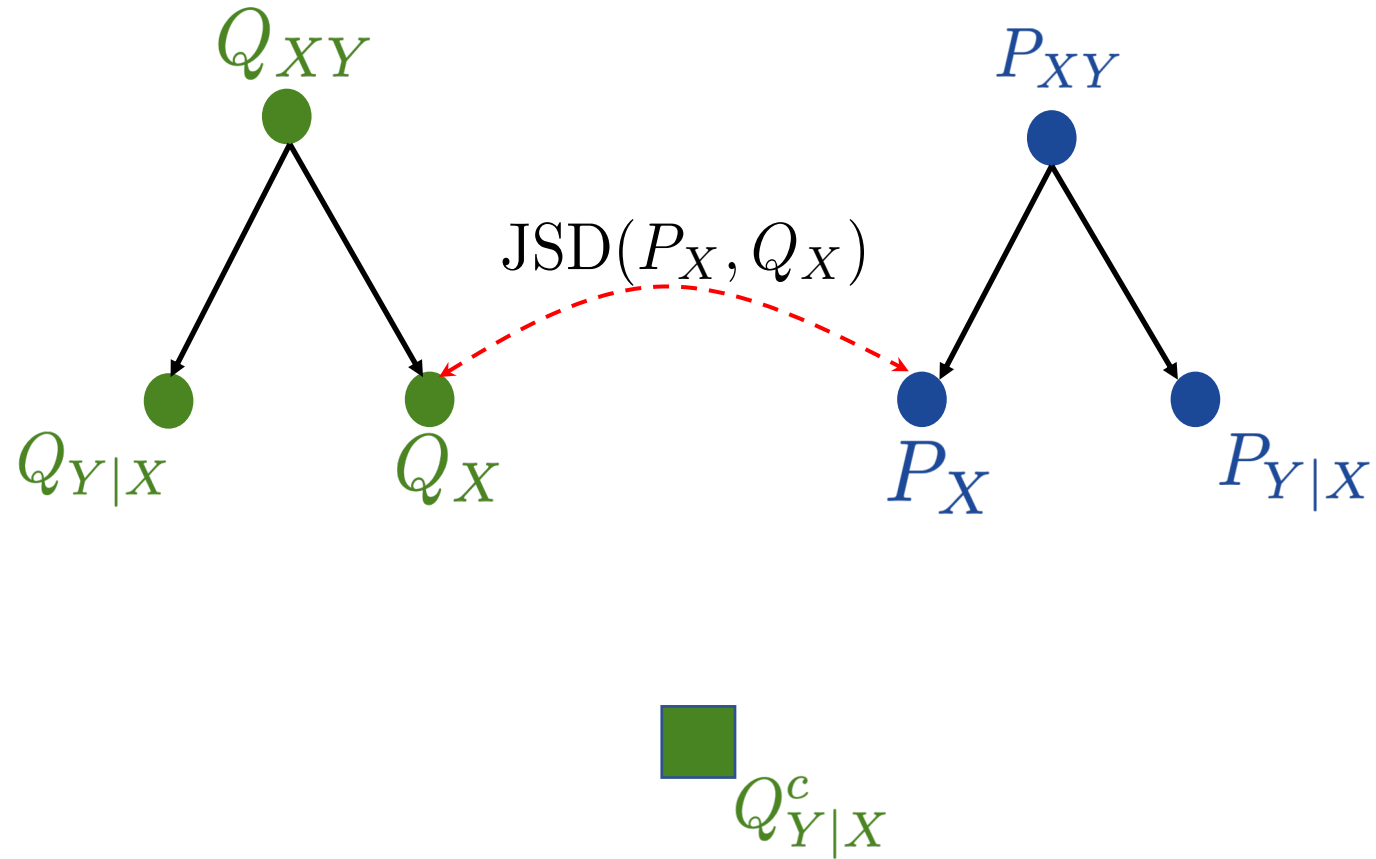
AC-GAN: Density Matching Point of View

P data
 Q estimated
 XY joint
 X data
 Y label
 $Y|X$ conditional



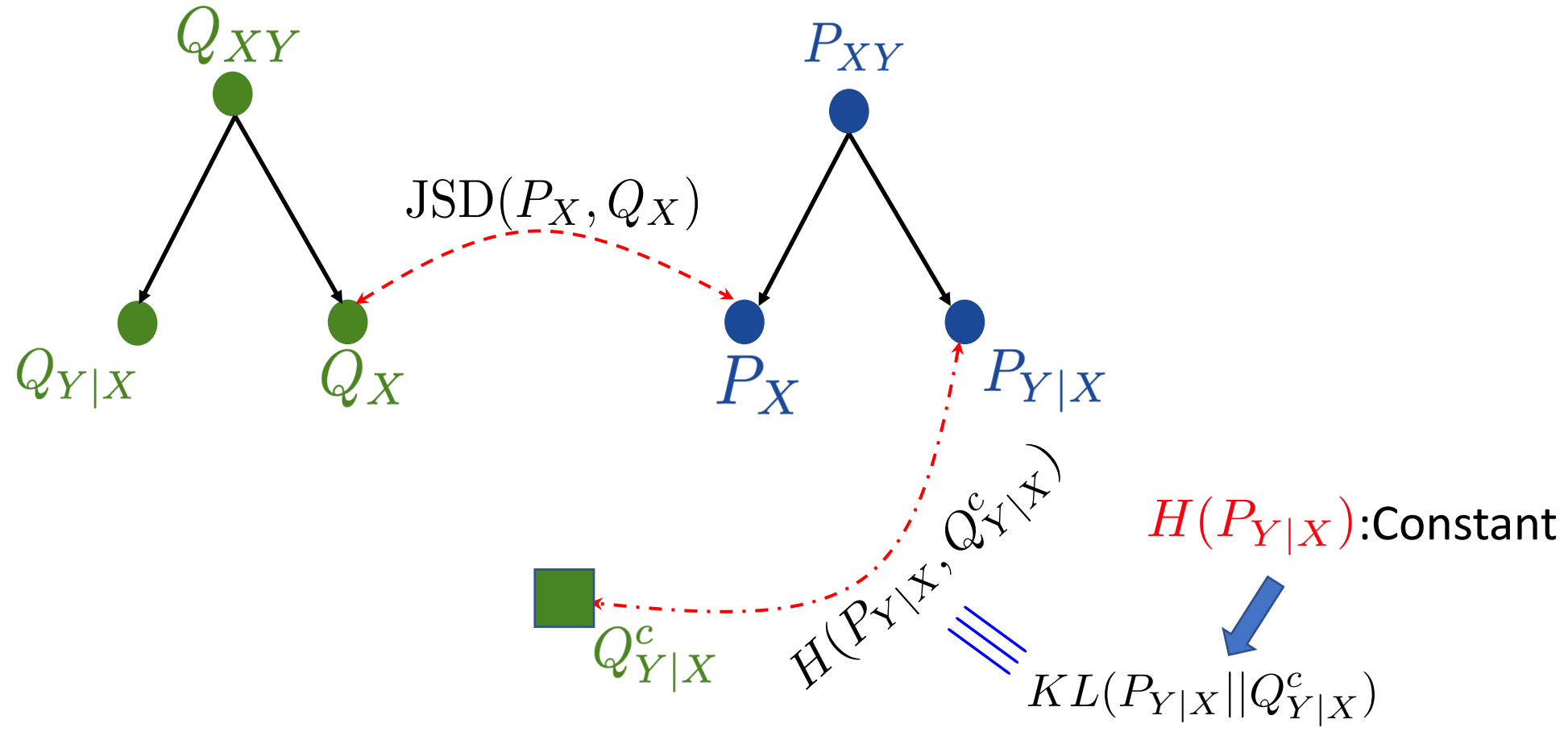
AC-GAN: Density Matching Point of View

P data
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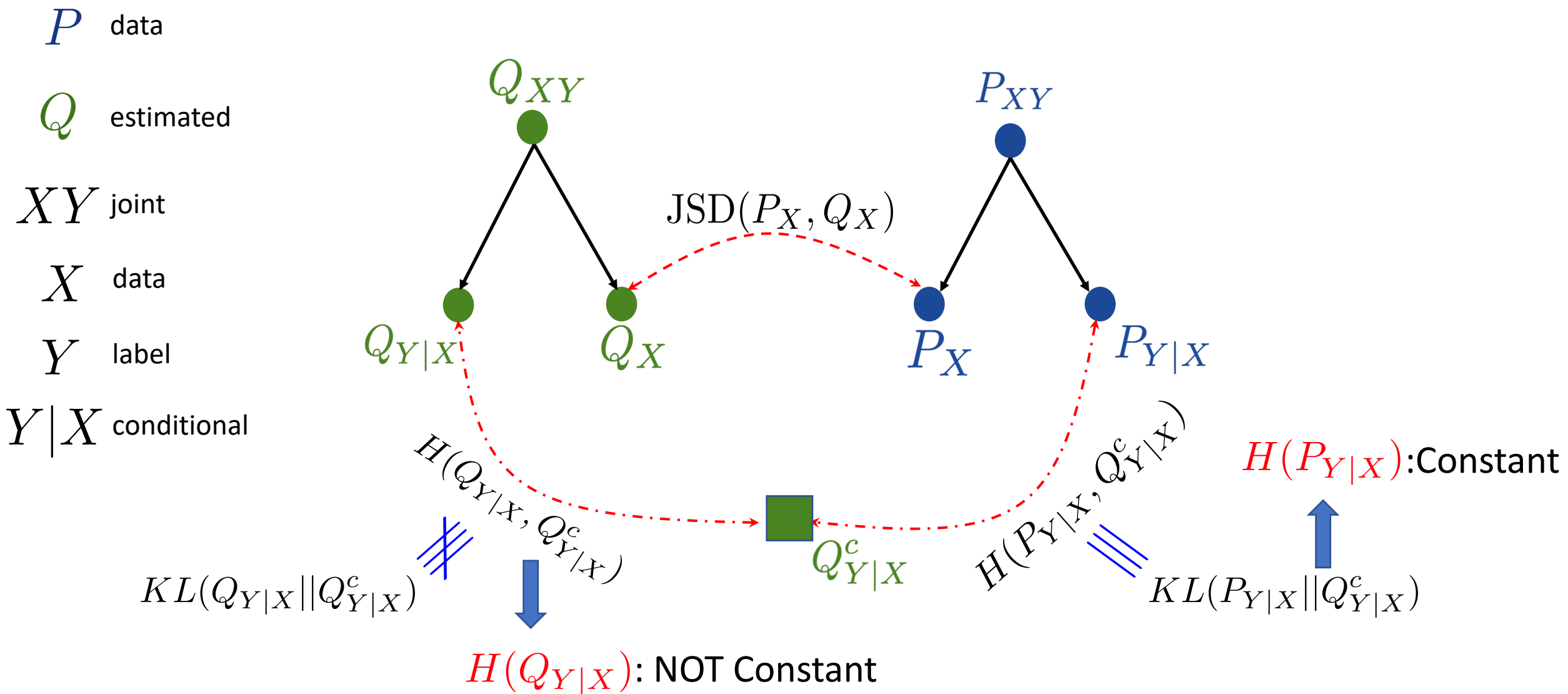


AC-GAN: Density Matching Point of View

P data
 Q estimated
 XY joint
 X data
 Y label
 $Y|X$ conditional



AC-GAN: Density Matching Point of View



Conversion to a Min-Max Game

Proposition:

- If $p(Y)$ is a uniform distribution, the following are equivalent:
 - Maximizing $H_Q(Y|X)$

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Conversion to a Min-Max Game

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 - Maximizing $H_Q(Y|X)$
 - Minimizing $I_Q(X, Y)$
 - Minimizing $JSD(Q_{X|Y=1}, Q_{X|Y=2}, \dots, Q_{X|Y=K})$

Conversion to a Min-Max Game

Proposition:

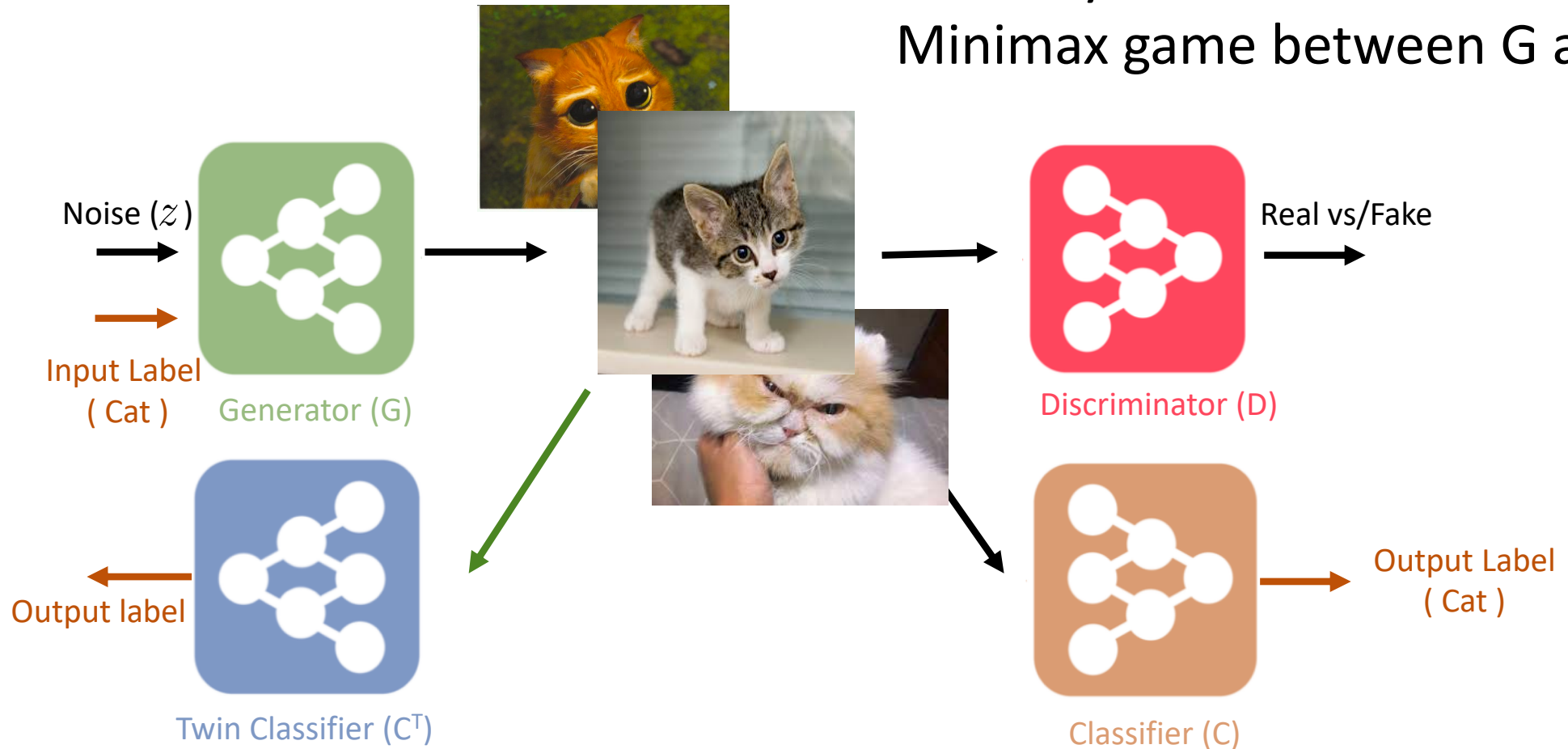
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A Min-Max game can be introduced with a twin classifier!

Twin Auxiliary Classifier Conditional GAN(TAC-GAN)

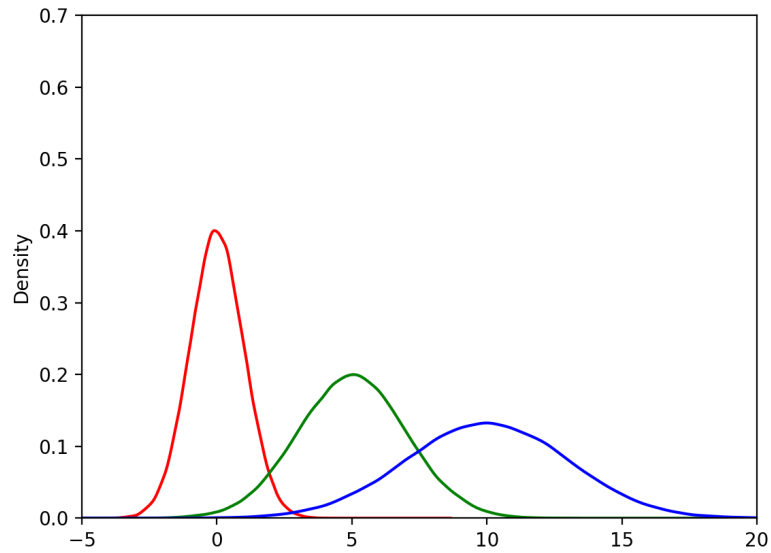
Minimax game between G and D
Auxiliary classifier C
Minimax game between G and C^T



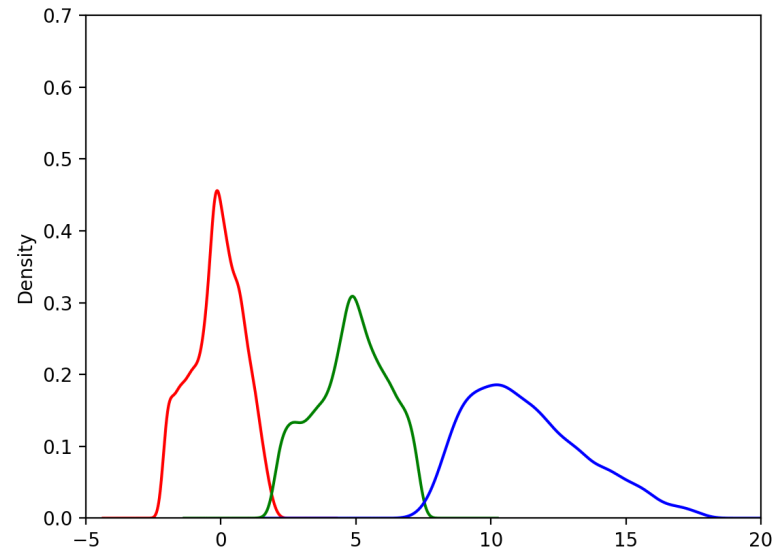
Back to 1D Mixture of Gaussian

- Class_0
- Class_1
- Class_2

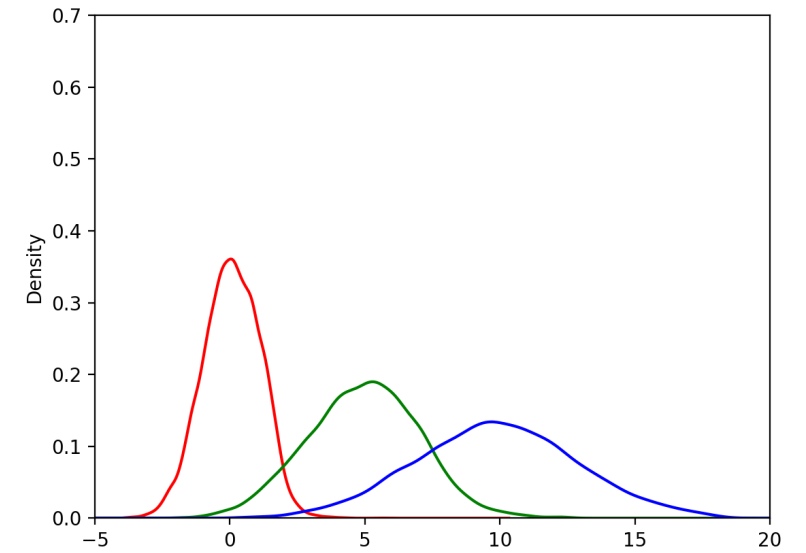
True Distribution



AC-GAN



Our Method



Better diversity

TAC-GAN (Ours)



Bird

Spider

Dog



AC-GAN

Comparison with
projection GAN!

Quantitative results!

Poster #87



Twin Auxiliary Classifiers GAN (TAC-GAN)