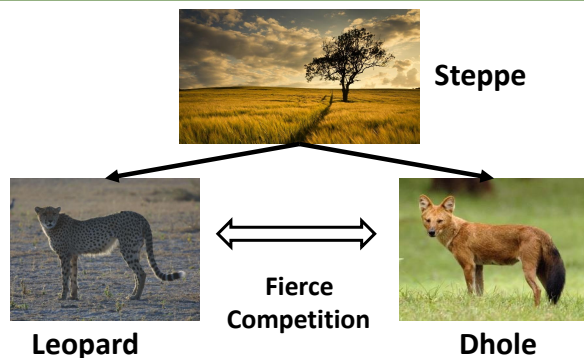


Multi-Entity Dependence Learning with Rich Context via Conditional Variational Auto-encoder



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Multi-entity interaction

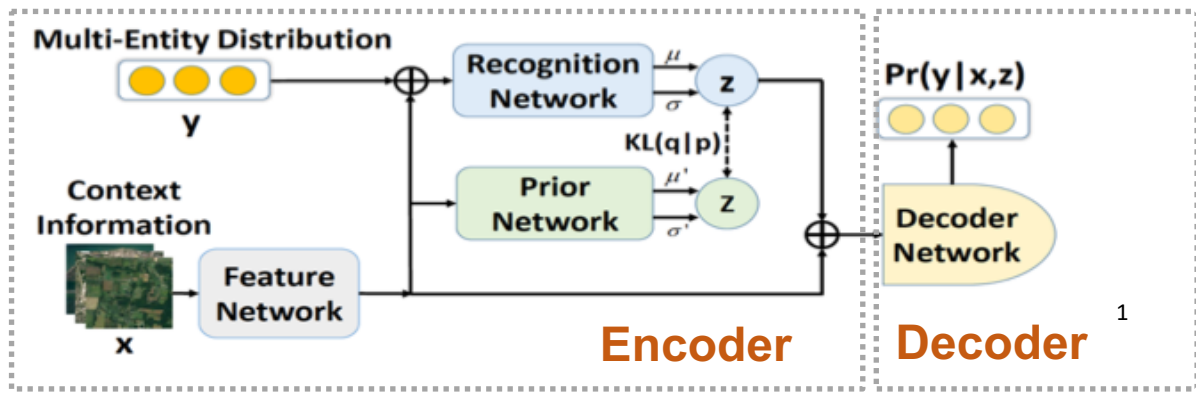
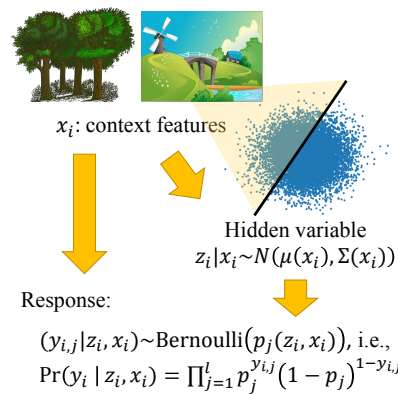


Multi-entity dependence learning

$$\Pr(y_1, y_2, \dots, y_n \mid \text{environ.})$$

$$\Pr(\text{Leopard} = 1, \text{Dhole} = 0 \mid \text{Steppe})$$

Conditional Variational Auto-encoder Framework



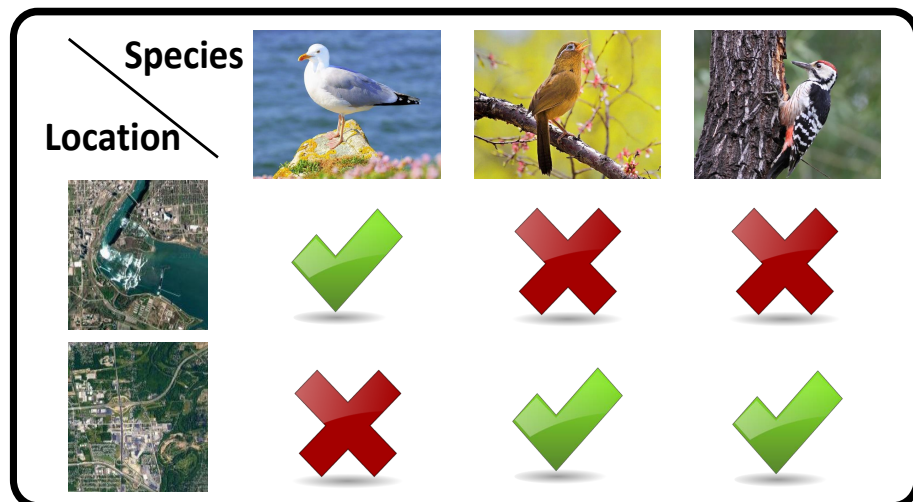
Multi-Entity Dependence Learning with Rich Context via Conditional Variational Auto-encoder



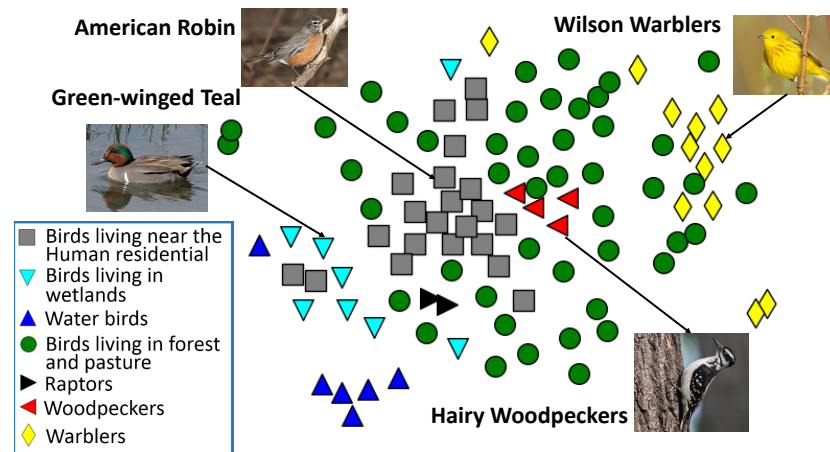
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Model species interactions using the *eBird* data



Landscape categorization using satellite images



Method	Neg. JLL	Time (min)
NLCD+MLP	36.32	2
Image256+ResNet50	34.16	5.3 hrs
NLCD+Image256+ResNet50	34.48	5.7 hrs
NLCD+Hist64+MLP	34.97	3
NLCD+Hist128+MLP	34.62	4
NLCD+Image64+MLP	33.73	9
NLCD+MLP+PCC	35.99	21
NLCD+Hist128+MLP+PCC	35.07	33
NLCD+Image64+MLP+PCC	34.48	53
NLCD+DMSE	30.53	20 hrs
NLCD+MLP+MEDL_CVAE	30.86	9
NLCD+Hist64+MLP+MEDL_CVAE	28.86	20
NLCD+Hist128+MLP+MEDL_CVAE	28.71	22
NLCD+Image64+MLP+MEDL_CVAE	28.24	48