

Supplementary Material: Sequential Latent Spaces for Modeling the Intention During Diverse Image Captioning

In this supplementary material we first present results on consensus reranking before discussing training details and a user study. We finally present additional qualitative results.

1. Consensus Reranking

We present best- k accuracy results and best-1 consensus reranking subsequently.

1.1. Best-K Accuracy

In Fig. 1 and Fig. 2 we compare the best- k -th ($k \in \{1, \dots, 10\}$) CIDEr scores of **Seq-CVAE** with other baseline methods. A good diverse captioning model should generate not just 1 but k good captions for a given image. Note, our **Seq-CVAE** has comparable accuracy to Beam Search, Div-BS and the POS [1] approach. We outperform AG-CVAE [5], which is the only other VAE method, by a large margin. The accuracy for AG-CVAE drops significantly, such that the 10th caption has a poor CIDEr score of ~ 0.55 . We show best-10 CIDEr accuracy for two cases: (1) 20 samples taken from the latent space (Fig. 1); and (2) 100 samples taken from the latent space (Fig. 2).

From Table 2 in the main paper, we observe that **Seq-CVAE** outperforms all the other methods on various diversity metrics by a large margin.

1.2. Best-1 Consensus Reranking

Consistent with the approach in [1], in Tab. 1 we compare the best-1 consensus reranking scores for various methods. We show that **Seq-CVAE** has the best CIDEr for 100 samples.

2. Training Details

We use the ADAM optimizer to train our model, with an initial learning rate of $4e^{-4}$. We decay the learning rate by 0.8 every 3rd epoch. Consistent with baseline methods we compare with, for our best numbers in Table 1 (main paper) we also fine-tune the VGG16 from the 5th epoch onwards. The starting learning rate for the VGG fine-tuning is $5e^{-5}$ and we decay it by 0.1 every 5th epoch. For more stable training of the VAE, we employ controlled capacity increase

CIDEr score of consensus re-ranked best-10 captions from 20 samples

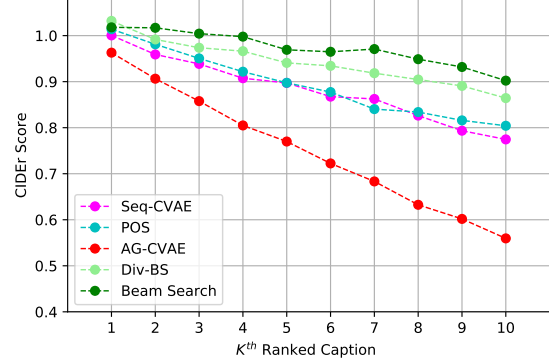


Figure 1: Best-10 CIDEr accuracy from 20 samples, ranked by consensus-reranking. Our **Seq-CVAE** achieves best- k accuracy comparable to Beam Search and Div-BS with higher diversity. **Seq-CVAE** outperforms the best- k scores of AG-CVAE.

CIDEr score of consensus re-ranked best-10 captions from 100 samples

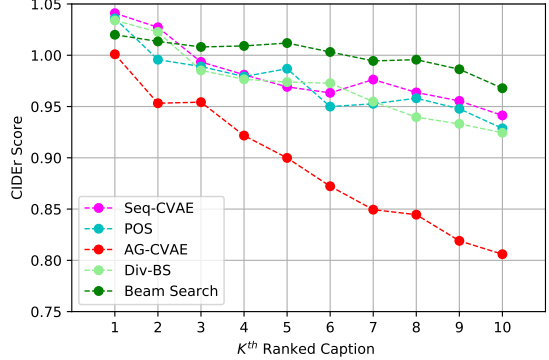


Figure 2: Best-10 CIDEr accuracy from 100 samples, ranked by consensus-reranking. Our **Seq-CVAE** achieves best- k accuracy comparable to Beam Search and better than Div-BS and POS with higher diversity. **Seq-CVAE** outperforms the best- k scores of AG-CVAE by a considerable margin.

and KL-annealing [2] as is standard within the community.

3. User Study

We perform a user study by randomly selecting 295 images and 3 captions each for **Seq-CVAE**, AG-CVAE and POS, per image. As shown in Tab. 2, **Seq-CVAE** outper-

Method		Best-1 Consensus Reranking Accuracy							
		B4	B3	B2	B1	C	R	M	S
Beam size #samples: 20	Beam search	0.319	0.423	0.564	0.733	1.018	0.537	0.255	0.185
	Div-BS [4]	0.320	0.424	0.562	0.729	1.032	0.536	0.255	0.184
	AG-CVAE [5]	0.299	0.402	0.544	0.716	0.963	0.518	0.237	0.173
	POS [1]	0.306	0.419	0.570	0.744	1.014	0.531	0.252	0.188
	Seq-CVAE	0.289	0.402	0.554	0.731	1.000	0.521	0.245	0.175
Beam size #samples: 100	Beam Search	0.317	0.419	0.558	0.729	1.020	0.532	0.253	0.186
	Div-BS [4]	0.325	0.430	0.569	0.734	1.034	0.538	0.255	0.187
	AG-CVAE [5]	0.311	0.417	0.559	0.732	1.001	0.528	0.245	0.179
	POS [1]	0.311	0.421	0.567	0.737	1.036	0.530	0.253	0.188
	Seq-CVAE	0.308	0.419	0.568	0.743	1.041	0.531	0.248	0.178

Table 1: **Best-1 Consensus Reranking Accuracy.** Our **Seq-CVAE** method obtains high scores on standard captioning metrics. We obtain comparable accuracy when compared to both the very recently proposed POS approach [1] which uses a part-of-speech prior and also to the AG-CVAE method [5]. Both these methods use additional information in the form of object vectors from a Faster-RCNN [3] during inference. In contrast, we do not use any additional information during inference. To calculate the best-1 accuracy, we report the caption with highest CIDEr score from the consensus reranked 20 and 100 captions.

forms AG-CVAE 67% of the time. It performs almost on par with the POS approach, with 48% success.

Baseline Method	Seq-CVAE Wins	Baseline Method Wins
AG-CVAE [5]	67%	33%
POS [1]	48%	52%

Table 2: We show the user captions sampled from best- k (same k^{th} ranked, $k \in \{1, \dots, 20\}$) for **Seq-CVAE**, AG-CVAE [5] and POS methods. The user is asked to pick one out of the two provided captions that best describes the image. User is not aware of the approach generating the caption. We observe that **Seq-CVAE** outperforms AG-CVAE and performs on par with the POS. We showed 295 images, with 3 captions each for each of the 3 methods.

4. Qualitative Results

In subsequent pages we show images and 3 captions generated by **Seq-CVAE** and other baseline methods.






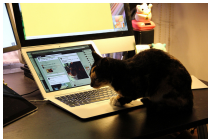
Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a cat sitting on top of a wooden chair • a cat with a collar sits next to a mirror • a cat sitting on top of a table 	<ul style="list-style-type: none"> • a black cat is laying on a couch • a black cat laying on a wooden table • a black cat is laying down on a couch 	<ul style="list-style-type: none"> • a black and white cat sitting on a table. • a black and white cat sitting on a couch. • a black and white cat laying on a chair. 	<ul style="list-style-type: none"> • a black cat laying on top of a wooden table • a black cat laying on top of a couch • a black cat is laying on a couch 	<ul style="list-style-type: none"> • a black cat sitting on top of a pizza • a black cat laying on top of a couch • a black cat laying on top of a pizza
	<ul style="list-style-type: none"> • a group of birds on some water near water • a couple of birds standing on top of a body of water • two white birds are standing by the water 	<ul style="list-style-type: none"> • a couple of birds that are standing in the water • a couple of birds are standing in the water • two birds standing in a body of water 	<ul style="list-style-type: none"> • a couple of birds are standing in the water. • a couple of birds standing on top of a rock. • a white and white bird standing in the water. 	<ul style="list-style-type: none"> • a couple of birds standing on top of a lake • a couple of birds standing on top of a body of water • a couple of birds that are standing in water 	<ul style="list-style-type: none"> • a couple of birds standing in the water • a couple of birds that are standing in the water • a couple of birds standing on a body of water
	<ul style="list-style-type: none"> • a giraffe standing in front of a wall • a giraffe standing in front of a wooden fence in a zoo enclosure • a giraffe standing next to a wall with a wall behind 	<ul style="list-style-type: none"> • a giraffe standing next to a building in a zoo • a giraffe standing in front of a building • a baby giraffe is standing in a zoo enclosure 	<ul style="list-style-type: none"> • a couple of giraffe standing next to each other. • a giraffe standing next to a group of giraffes. • a giraffe standing in front of a building. 	<ul style="list-style-type: none"> • a giraffe standing next to a brick wall • a giraffe standing next to a stone wall • a giraffe standing in front of a brick wall 	<ul style="list-style-type: none"> • a giraffe standing next to a brick wall • a giraffe standing next to a stone wall • a giraffe standing next to a wooden fence
	<ul style="list-style-type: none"> • a bathroom with a toilet and a sink • a bathroom with a toilet and sink in it • a small bathroom with a toilet in the floor 	<ul style="list-style-type: none"> • a white toilet in a small bathroom with a window • a toilet in a bathroom with a window • a white toilet in a bathroom with a toilet 	<ul style="list-style-type: none"> • a bathroom with a toilet and a sink. • a small bathroom with a toilet and a sink. • a small bathroom with a toilet and a window. 	<ul style="list-style-type: none"> • a white toilet sitting in a bathroom next to a wall • a white toilet sitting in a bathroom next to a window • a white toilet sitting in a bathroom next to a door 	<ul style="list-style-type: none"> • a white toilet sitting in a bathroom next to a wall • a white toilet sitting in a bathroom next to a window • a white toilet sitting in a bathroom next to a door
	<ul style="list-style-type: none"> • a man standing on the beach playing frisbee on a beach • a man in a red shirt playing frisbee • a man in a red shirt playing frisbee on a beach 	<ul style="list-style-type: none"> • a man is playing with a frisbee on the beach • a man is about to throw a frisbee on the beach • a man prepares to throw a frisbee on the beach 	<ul style="list-style-type: none"> • a man holding a frisbee on a beach. • a man with a frisbee on a beach. • a man is throwing a frisbee on the beach. 	<ul style="list-style-type: none"> • a man holding a frisbee on the beach • a man holding a frisbee on a beach • a man holding a frisbee on top of a beach 	<ul style="list-style-type: none"> • a man is holding a frisbee on the beach • a man holding a frisbee on the beach • a man playing with a frisbee on the beach
	<ul style="list-style-type: none"> • a cat with a laptop on top of a laptop • a cat sitting in front of a laptop computer • a cat sitting on a laptop keyboard next to a laptop 	<ul style="list-style-type: none"> • a cat sitting on top of a laptop computer • a cat is sitting on a laptop computer • a cat sitting on a laptop computer on a desk 	<ul style="list-style-type: none"> • a cat sitting on top of a laptop computer. • a cat sitting on top of a desk next to a laptop. • a black and white cat sitting on top of a laptop. 	<ul style="list-style-type: none"> • a cat sitting on a desk next to a laptop computer • a cat is sitting on a laptop computer • a cat sitting on a desk next to a laptop 	<ul style="list-style-type: none"> • a cat sitting on top of a laptop computer • a cat sitting on a desk next to a laptop computer • a cat is sitting next to a laptop computer

Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a man and a woman standing around a living room • two people standing in a living room playing a game • the two young people are playing a video game 	<ul style="list-style-type: none"> • two people playing a video game in a living room • two people playing a video game in a living room • a young man is playing a video game in a living room 	<ul style="list-style-type: none"> • two men are playing a video game in a living room. • two men playing a video game in a living room. • a group of people in a living room playing wii. 	<ul style="list-style-type: none"> • two people standing in a living room playing a video game • two people playing a video game in a living room • two people standing in a living room playing wii 	<ul style="list-style-type: none"> • two people in a living room playing a video game • two people standing in a living room playing a video game • two people are playing a video game in a living room
	<ul style="list-style-type: none"> • a glass vase filled with a flower in it • a glass vase is sitting on a table • a glass vase with flowers inside of it 	<ul style="list-style-type: none"> • a small glass vase with some flowers in it • a vase with a bunch of flowers in it • a close up of a vase with flowers in the background 	<ul style="list-style-type: none"> • a glass vase with a vase of flowers in it. • a glass vase with a vase of flowers on it. • a glass vase with a glass of flowers in it. 	<ul style="list-style-type: none"> • a glass vase with some flowers in it • a glass vase filled with lots of flowers • a glass vase with flowers in it next to a window 	<ul style="list-style-type: none"> • a glass vase filled with flowers on a table • a glass vase filled with flowers sitting on a table • a glass vase with flowers in it sitting on a table
	<ul style="list-style-type: none"> • a white white sink in the bathroom next to • a bathroom with a toilet and a sink • a bathroom with a sink and a toilet 	<ul style="list-style-type: none"> • a very small bathroom with a sink and a mirror • a white bathroom with a sink and mirror • a very small bathroom with a sink and mirror 	<ul style="list-style-type: none"> • a bathroom with a sink and a window. • a bathroom with a sink and a mirror. • a white bathroom with a sink and a mirror. 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror • a bathroom with a sink and a large mirror • a bathroom with a sink and a mirror in it 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror • a bathroom with a sink and a window • a white bathroom with a sink and a mirror
	<ul style="list-style-type: none"> • a street sign and a traffic light on a street • a street with a traffic light on the street • a street light on a city street with traffic 	<ul style="list-style-type: none"> • a stop sign in front of a building with traffic lights • cars are parked on the side of a city street • a red stop sign on a city street 	<ul style="list-style-type: none"> • a city street with a traffic light on it. • an intersection with a street sign and a traffic light. • a street scene with a traffic light on the side. 	<ul style="list-style-type: none"> • a stop sign on the corner of a city street at night • a stop sign on the corner of a city street • a stop sign on the corner of a street next to a traffic 	<ul style="list-style-type: none"> • an intersection with a stop sign and street signs • a stop sign on the corner of a city street • a stop sign on the corner of an empty street
	<ul style="list-style-type: none"> • a person is surfing in the ocean waves • a couple of people riding a wave in the ocean • a surfer riding a wave while riding a wave 	<ul style="list-style-type: none"> • a man riding a wave on a surfboard in the ocean • a surfer riding a wave in the ocean • a man riding a wave on top of a surfboard 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard. • a person riding a wave on top of a surfboard. • a man on a surfboard riding a wave. 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard • a man riding a wave on a surfboard • a man riding a wave on a surfboard in the ocean 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard • a man riding a wave on a surfboard • a person riding a wave on top of a surfboard
	<ul style="list-style-type: none"> • a man sitting on a couch next to a man sitting on a couch • a man sitting on a couch while sitting on a couch • a man sitting in a chair while holding a camera 	<ul style="list-style-type: none"> • a group of people are sitting on a couch • a group of people that are sitting on a couch • two people sitting on a couch with a man in a room 	<ul style="list-style-type: none"> • a group of people sitting on a couch. • a man and a woman sitting on a couch. • a group of people sitting on top of a couch. 	<ul style="list-style-type: none"> • a couple of people sitting on a couch • a couple of people that are sitting on a couch • a couple of people sitting on a couch in a room 	<ul style="list-style-type: none"> • a group of people sitting on a couch • a couple of men sitting on a couch • a couple of people sitting on a couch






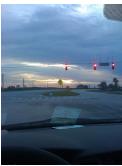






Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a man is standing on a ski slope with his skis • a man in a red jacket is skiing on a snowy slope • a young man in a red jacket is skiing down 	<ul style="list-style-type: none"> • a man on skis is standing in the snow • a man riding skis on a snow covered slope • a man riding skis on a snowy slope 	<ul style="list-style-type: none"> • a man and a woman standing on skis in the snow. • a man and a woman on skis in the snow. • a group of people on skis in the snow. 	<ul style="list-style-type: none"> • a man riding skis on top of a snow covered slope • a man riding skis down a snow covered slope • a man riding skis down a snow covered ski slope 	<ul style="list-style-type: none"> • a man riding skis on a snow covered slope • a man riding skis on top of a snow covered slope • a man riding skis down a snow covered slope • a man riding skis down a snow covered ski slope
	<ul style="list-style-type: none"> • a man in a water skis standing in a body of water • a woman is in the water with a paddle board with a body of • a man standing on a river next to a large river 	<ul style="list-style-type: none"> • a man on a surfboard is in the water • a man is riding a surfboard in the water • a man is standing out in the water 	<ul style="list-style-type: none"> • a couple of people that are standing in the water. • a couple of people standing next to a body of water. • a man and a woman are standing in the water. 	<ul style="list-style-type: none"> • a man that is standing on a board in the water • a man that is standing in the water • a man that is standing on a board in a river 	<ul style="list-style-type: none"> • a man riding a board on top of a body of water • a man riding a board on top of a lake • a man on a board in the water
	<ul style="list-style-type: none"> • a small kitchen with a bunch of toilets • a white toilet and a small amount of items • a white toilet sitting next to a sink 	<ul style="list-style-type: none"> • a small bathroom with a toilet and sink • a man standing next to a toilet and sink • a man standing in front of a toilet 	<ul style="list-style-type: none"> • a bathroom with a toilet and a sink. • a small bathroom with a toilet and a table. • a man is standing in the bathroom with a toilet. 	<ul style="list-style-type: none"> • a man standing in a bathroom next to a sink and toilet • a man standing in a bathroom next to a sink and a toilet • a man standing in a bathroom next to a sink 	<ul style="list-style-type: none"> • a person in a bathroom with a toilet and sink • a person standing in a bathroom with a toilet and sink • a bathroom with a sink and a toilet
	<ul style="list-style-type: none"> • a bicycle with a bicycle rack attached to it and a car • a bicycle is parked in front of a building • a bicycle is parked in a city with people walking down 	<ul style="list-style-type: none"> • a man riding a bike in front of a store • a man walking down a street next to a bike • a person riding a bike down a street 	<ul style="list-style-type: none"> • a group of people standing in front of a building. • a large group of people standing in front of a building. • a group of people sitting in front of a building. 	<ul style="list-style-type: none"> • a bicycle is parked in front of a building • a bicycle parked in front of a store • a bicycle is parked in front of a store 	<ul style="list-style-type: none"> • a person riding a bike in front of a store • a person riding a bike on a city street • a person riding a bike in front of a restaurant
	<ul style="list-style-type: none"> • a bathroom with a sink toilet and mirror • a bathroom that has a sink next to a • a bathroom with a sink and a toilet 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror • a bathroom with a sink and mirror in it • a bathroom with a sink and a large mirror 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror. • a bathroom with a white sink and a mirror. • a bathroom with a large white sink and a large mirror. 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror • a bathroom with a sink and a mirror in it • a bathroom with a sink and mirror in it 	<ul style="list-style-type: none"> • a bathroom with a sink and a mirror • a bathroom with a sink and a tub • a bathroom with a sink and a bath tub
	<ul style="list-style-type: none"> • a car driving down a street filled with cars • a traffic light on a street with a traffic light • a car with a red light on the side of the road 	<ul style="list-style-type: none"> • a traffic light with a car on it at an intersection • a view of a red traffic light at an intersection with a traffic • a view of a red traffic light and cars 	<ul style="list-style-type: none"> • a large red and white plane flying over a cloudy sky. • a plane flying in the sky over a city. • a large airplane is flying over a cloudy sky. 	<ul style="list-style-type: none"> • a view of a stop light at an intersection • a view of an intersection with a stop light • a view of a stop light at an intersection with a red traffic 	<ul style="list-style-type: none"> • a couple of traffic lights on a street • a stop light at an intersection with a red traffic light • a stop light at an intersection with a red traffic signal

Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a person riding a horse near a lush green field • a man on a horse with a horse in the background • a woman riding on a horse next to a woman 	<ul style="list-style-type: none"> • a man is riding a horse in a field • a young man riding a horse in a field • a person riding a horse in a field 	<ul style="list-style-type: none"> • a man is riding a horse in a field. • a man is sitting on a horse in a field. • a man sitting on a horse in a field. 	<ul style="list-style-type: none"> • a man riding on the back of a brown horse • a man riding on the back of a horse in a field • a man riding on the back of a horse 	<ul style="list-style-type: none"> • a man riding on the back of a brown horse • a person riding on the back of a brown horse • a woman riding on the back of a brown horse
	<ul style="list-style-type: none"> • a bed sitting on top of a bed • a wooden bed sitting in the middle of • a wooden bench sitting in a room with a window 	<ul style="list-style-type: none"> • a large white bed in a small room • a bed in a room with a wooden headboard • a bed room with a large bed in it 	<ul style="list-style-type: none"> • a bedroom with a bed and a table. • a bedroom with a bed and a window. • a bedroom with a bed and a lamp. 	<ul style="list-style-type: none"> • a bed sitting in a bedroom next to a window • a bed sitting in a bedroom next to a table • a bed sitting in a bedroom next to a wall 	<ul style="list-style-type: none"> • a bed sitting in a bedroom next to a window • a bed sitting in a bedroom next to a table • a bed sitting in a bedroom next to a wall
	<ul style="list-style-type: none"> • a desk with a laptop and a laptop computer • a desk with a laptop and a monitor on it • a large desk with a computer and a laptop 	<ul style="list-style-type: none"> • a laptop computer sitting on top of a desk • a desk with a laptop computer and monitor • a desk with a laptop and a keyboard 	<ul style="list-style-type: none"> • a desk with a laptop and a computer. • a laptop computer sitting on top of a desk. • a desk with a laptop computer and other items. 	<ul style="list-style-type: none"> • a desk with a laptop and a keyboard • a desk with a laptop computer sitting on top of it • a laptop computer sitting on top of a desk 	<ul style="list-style-type: none"> • a desk with a laptop and a computer on it • a desk with a laptop and a keyboard • a desk with a laptop and a computer
	<ul style="list-style-type: none"> • a large body of water with a city skyline in the background • a bridge is on a city skyline in the • a view of a large body of water with a boat floating 	<ul style="list-style-type: none"> • a bird is flying over the water near a lake • a bird is flying over a large body of water • a bird flying over a large body of water 	<ul style="list-style-type: none"> • a view of a large body of water. • a large body of water with a large sky in the background. • a large body of water with a lot of mountains. 	<ul style="list-style-type: none"> • a large body of water with a city in the background • a large body of water with a city in the distance • a large body of water with a bridge in the background 	<ul style="list-style-type: none"> • a large body of water with a city in the background • a large body of water with a bridge in the background • a flock of birds flying over a body of water
	<ul style="list-style-type: none"> • a little girl is sitting on the bench and looking • a little girl is sitting in a park bench • a woman standing in a park on a sunny day 	<ul style="list-style-type: none"> • a woman standing on a wooden bench in a park • a woman with a hat sitting on a bench • a young girl standing on a park bench with a child 	<ul style="list-style-type: none"> • a man and a woman sitting on a bench. • a man and a woman are sitting on a bench. • a man and a woman are standing on a bench. 	<ul style="list-style-type: none"> • a couple of people that are sitting on a park bench • a couple of people that are on a park bench • a couple of people that are standing on a park bench 	<ul style="list-style-type: none"> • a couple of people that are on a park bench • a little girl that is sitting on a park bench • a couple of people that are sitting on a bench
	<ul style="list-style-type: none"> • a man standing on a snowy slope while another person is riding his snowboard • a group of snowboarders on a hill slope • a group of people on snowboards and snowboards down 	<ul style="list-style-type: none"> • a man riding a snowboard down a snow covered slope • a person on a snowboard going down a hill • a man is skiing down a hill on a snowboard 	<ul style="list-style-type: none"> • a man riding a snowboard down a snow covered slope. • a person riding a snowboard on top of a snow covered slope. • a man riding a snowboard on top of a snow covered slope. 	<ul style="list-style-type: none"> • a group of people riding skis down a snow covered slope • a group of people riding skis on top of a snow covered slope • a group of people riding skis down a snow covered ski slope 	<ul style="list-style-type: none"> • a man riding a snowboard down a snow covered slope • a person riding a snowboard down a snow covered slope • a man riding a snowboard down the side of a snow covered slope

Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a man standing next to a surfboard on the beach • a man standing on a surfboard holding a surfboard • a man holding a surfboard while standing on a beach 	<ul style="list-style-type: none"> • a man is holding a surfboard on a beach • a man holding a surfboard on a beach • a man standing on top of a surfboard in the ocean 	<ul style="list-style-type: none"> • a man on a surfboard in the water with a dog. • a man and a woman on a surfboard in the water. • a man on a surfboard with a dog on a beach. 	<ul style="list-style-type: none"> • a man on a surfboard in the water with a surfboard • a man on a surfboard in the ocean • a man on a surfboard in the ocean 	<ul style="list-style-type: none"> • a man standing on a surfboard in the water • a man riding a surfboard on top of a beach • a person riding a surfboard on a body of water
	<ul style="list-style-type: none"> • a cow standing in the grass with a camera in the background • a cow stands and looking at the camera • a cow is standing in a field looking at 	<ul style="list-style-type: none"> • a brown and white cow standing in a field • a brown cow is standing in a field • a brown cow is standing up in a field 	<ul style="list-style-type: none"> • a brown horse with a white cow in its mouth. • a brown dog with a white and white cow in its mouth. • a brown cow with a white cow in its mouth. 	<ul style="list-style-type: none"> • a close up of a cow standing in a field • a close up of a cow in a field • a close up of a cow in a field of grass 	<ul style="list-style-type: none"> • a brown and white cow standing in a field • a close up of a cow standing in a field • a close up of a cow standing in the grass
	<ul style="list-style-type: none"> • a man in a field with a frisbee • a man standing in a field holding a • a man in a field throwing a frisbee 	<ul style="list-style-type: none"> • a young man is playing baseball in the field • a man in a field throwing a baseball • a man is throwing a baseball in a field 	<ul style="list-style-type: none"> • a man in a field playing a game of baseball. • a person in a field playing a game of baseball. • a young boy is playing a game of baseball. 	<ul style="list-style-type: none"> • a young boy in a green shirt is throwing a frisbee • a boy in a green shirt is playing a game of baseball • a young boy standing on top of a lush green field 	<ul style="list-style-type: none"> • a man standing on top of a lush green field • a young man standing on top of a lush green field • a young boy standing on top of a lush green field
	<ul style="list-style-type: none"> • a street corner with a sign that says @UNKNOWN@ @UNKNOWN@ and @UNKNOWN@ • a street scene with a large sign on the street • a street scene with a sign and a sign on the side of it 	<ul style="list-style-type: none"> • a street sign on a city street at night • a street sign is in front of a building • a street sign in front of a building with many people 	<ul style="list-style-type: none"> • a sign on a city street in front of a building. • a street sign that is on the side of a building. • a sign that is on the side of a building. 	<ul style="list-style-type: none"> • a couple of people walking down a city street at night • a couple of people walking down a city street • a couple of people walking in front of a restaurant 	<ul style="list-style-type: none"> • a couple of people walking down a city street • a black and white photo of a city street • a group of people standing outside of a restaurant
	<ul style="list-style-type: none"> • a black and white plane on the runway • a small plane parked on a runway with • a small airplane sitting on a runway next to 	<ul style="list-style-type: none"> • a small airplane sitting on top of an airport runway • a small airplane is parked on the runway • a small airplane is parked outside on a runway 	<ul style="list-style-type: none"> • a small plane is parked on a runway. • a small airplane is parked in a field. • a small plane sitting on top of a runway. 	<ul style="list-style-type: none"> • a close up of a small plane on a runway • a black and white photo of a small plane • a black and white photo of a small plane on a runway 	<ul style="list-style-type: none"> • a small plane is parked on a runway • a small plane is parked on the runway • a propeller plane is parked on a runway
	<ul style="list-style-type: none"> • a man riding a surfboard on top of a wave • a man riding a wave in the ocean • a man is in the water riding a surfboard on 	<ul style="list-style-type: none"> • a man riding a wave on a surfboard • a man is riding a wave on a surfboard • a man riding a wave on top of a surfboard 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard. • a person riding a wave on top of a surfboard. • a man riding a surfboard on a wave in the ocean. 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard • a man riding a wave on a surfboard • a man riding a wave on a surfboard in the water 	<ul style="list-style-type: none"> • a man riding a wave on top of a surfboard • a person riding a wave on top of a surfboard • a man riding a wave on a surfboard in the ocean

Image	Seq-CVAE	POS	AG-CVAE	Div-BS	BS
	<ul style="list-style-type: none"> • a young man is riding a skateboard down a ramp • a man riding a skateboard down the side of a ramp • a skateboarder is doing tricks on a ramp 	<ul style="list-style-type: none"> • a man is on a skateboard at a skate park • a man riding a skateboard down the side of a ramp • a man riding a skateboard on a ramp at a park 	<ul style="list-style-type: none"> • a man is doing a trick on a skateboard. • a man that is standing on a skateboard. • a man flying through the air while riding a skateboard. 	<ul style="list-style-type: none"> • a man riding a skateboard up the side of a ramp • a young man riding a skateboard up the side of a ramp • a young man riding a skateboard up the side of a ramp in 	<ul style="list-style-type: none"> • a man riding a skateboard up the side of a ramp • a young man riding a skateboard up the side of a ramp • a man riding a skateboard down the side of a ramp
	<ul style="list-style-type: none"> • a large parking meter on the side of a street next to a parking • a parking meter sitting on the side of a road • two parking meters on a snowy road near the water 	<ul style="list-style-type: none"> • a parking meter sitting on the side of a road • a picture of a parking meter on a street • a parking meter sitting on the side of a snowy road 	<ul style="list-style-type: none"> • a black and white photo of a parking lot. • there is a black and white photo of a parking lot. • a black and white photo of a couple of snow. 	<ul style="list-style-type: none"> • a parking meter sitting on the side of a road • a parking meter sitting on the side of a beach • a couple of parking meters sitting on top of a street 	<ul style="list-style-type: none"> • a parking meter sitting on the side of a road • a parking meter on the side of a street • a parking meter sitting on the side of a street
	<ul style="list-style-type: none"> • a batter catcher and umpire during a baseball game • a baseball player is swinging his bat at • a baseball player is swinging a bat at a baseball game 	<ul style="list-style-type: none"> • a baseball player standing on home plate holding a bat • a baseball player holding a racket on top of a field • a baseball player that is standing on a court 	<ul style="list-style-type: none"> • a group of men playing a game of tennis. • two men are playing a game of tennis. • a tennis player is standing on the court. 	<ul style="list-style-type: none"> • a baseball player is getting ready to hit a ball • a baseball player holding a racket on a field • a group of men playing a game of baseball 	<ul style="list-style-type: none"> • a baseball player getting ready to hit a ball • a group of men on a field playing baseball • a baseball player holding a racket on a field
	<ul style="list-style-type: none"> • a box full of pizza that are on the table • a pizza sitting on a tray on top • a close up of a pizza box with a 	<ul style="list-style-type: none"> • a table with two pizzas and boxes of pizza • two pizzas sitting on a table with other boxes • a couple of different pizzas sitting on boxes 	<ul style="list-style-type: none"> • a pizza with a box of pizza on it. • a couple of pizzas sitting on top of a table. • a table with two pizzas on top of it. 	<ul style="list-style-type: none"> • two boxes of pizza sitting on top of a box • two boxes of pizza sitting on top of a table • two boxes of pizza sitting on top of a box on a table 	<ul style="list-style-type: none"> • a box of pizza sitting on top of a table • two boxes of pizza in a box on a table • a box of pizza sitting on a table
	<ul style="list-style-type: none"> • a large air plane on a runway • a large air plane is on a runway • a large blue and white plane sitting on top of an airport 	<ul style="list-style-type: none"> • several airplanes parked on the tarmac at an airport • a couple of airplanes are parked on a runway • a couple of airplanes that are parked on a runway 	<ul style="list-style-type: none"> • a large jetliner sitting on top of an airport runway. • a large jetliner sitting on top of an airport tarmac. • a large commercial airplane sitting on top of an airport runway. 	<ul style="list-style-type: none"> • a large jetliner sitting on top of an airport tarmac • a large jetliner sitting on top of an airport runway • a large jetliner sitting on top of an airport tarmac area 	<ul style="list-style-type: none"> • a large jetliner sitting on top of an airport tarmac • a large jetliner sitting on top of an airport runway • a large jetliner sitting on top of an airport
	<ul style="list-style-type: none"> • a man holding a baby holding a small child • a boy is holding a baby that is holding up a frisbee • a boy and a girl in a red and white shirt and a 	<ul style="list-style-type: none"> • a young boy holding a frisbee standing in the grass • a boy in a field holding a frisbee • a boy in a field holding a white frisbee 	<ul style="list-style-type: none"> • a man holding a frisbee in his hand. • a man in a red shirt is holding a frisbee. • a man and a woman are playing with a frisbee. 	<ul style="list-style-type: none"> • a young boy holding a frisbee in his hand • a young boy is holding a frisbee in his hand • a boy holding a frisbee in his hand 	<ul style="list-style-type: none"> • a young boy holding a frisbee in his hand • a boy is holding a frisbee in his hand • a young boy is holding a frisbee in his hand

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