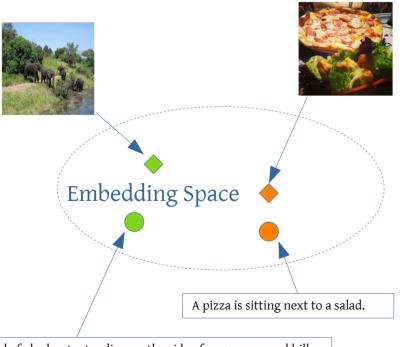
### Ladder Loss for Coherent Visual-Semantic Embedding

(AAAI-2020, Feb 7-12, New York, NY, USA)

Mo Zhou Xidian University Dec 25 2019

# Visual-Semantic Embedding

Cross-Modal Retrieval (image ←→ text)



### **WHAT**

- \* multi-modal joint embedding
- \* Map images & texts into a common space
- \* Images → Convolutional Neural Nets
- \* Text → Recurrent Neural Nets

### WHY

- \* Retrieval by comparing embedding distance
- \* Image/text generation using embedding vecs
- \* Visual question answering

A herd of elephants standing on the side of a grass covered hill.

## Visual-Semantic Embedding

- How
  - (1) Canonical Correlation Analysis (CCA)
  - (2) Deep metric learning-based embedding space learning

 Deep metric learning-based methods scale better to large scale datasets and achieve better performance

# Deep Metric Learning

### Metric

Given a set X, a metric is a (distance function)  $d: X \times X \mapsto [0, \infty)$ 

### **Visual-Semantic Embedding**

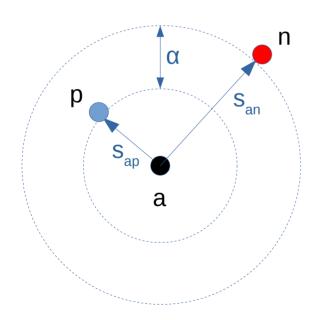
Image & Text embedding vectors  $X = \{x_{\text{image},1}, x_{\text{text},1}, ..., x_{\text{image},N}, x_{\text{text},N}\}$ 

### **Subtle problem: Loss functiom for DML**

- \* Contrastive loss (restrictive)
- \* Triplet loss (less-restrictive)
- \* Variants of Triplet loss, e.g. PDDM, Histogram Loss, quadruplets.
- \* n-pair loss
- \* lift-structure loss

# **Existing Problem**

Relevance → Binary Variable. e.g. Triplet loss



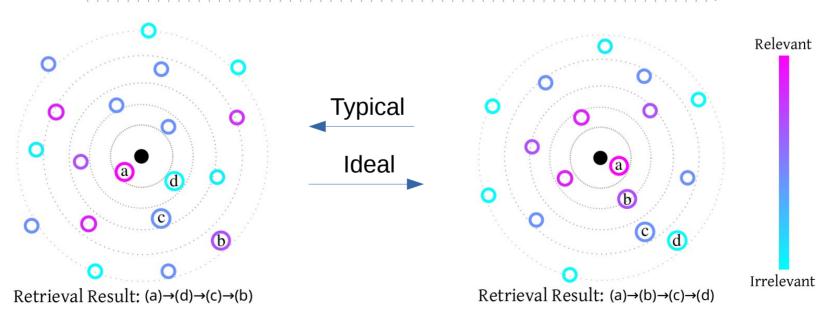
$$s(v_q, h_q) - s(v_q, h_p) > \alpha$$

$$L_{tri}(q) = \sum_{p \in \mathcal{N}^{-q}} [\alpha - s(v_q, h_q) + s(v_q, h_p)]_+,$$

# Existing Problem

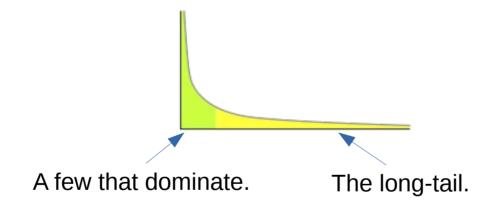


- (a) A herd of elephants standing on the side of a grass covered hill.
- **b** An elephant stands near water and a stone wall.
- © A pair of elephants with their trunks entwined.
- d A group of four skiers posing for a picture.



# Long-Tail Query

• Where a matching candidate may not necessarily exist in the database.



Typical embedding models will fail to retrieve the "most relevant" candidates.

## Our Approach

- Relevance Degree (Continuous Variable)
- Ladder Loss (Extended form of Triplet Loss)
- Coherent Score (Evaluate Ranking Coherence)

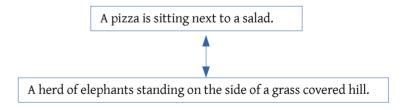
# Relevance Degree



<u>Ideal ground-truth: Human Annotation | Combinatorial Explosion</u>

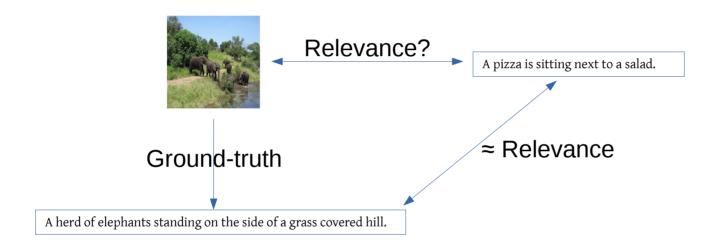


Single-modal (image) similarity.



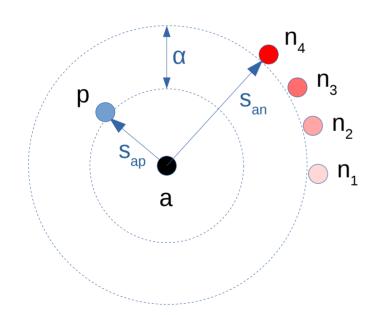
Single-modal (text) similarity.

# Relevance Degree



$$R(i_q, t_p) = R(t_q, t_p) = BERT(t_q, t_p).$$

### Triplet Loss



$$s(v_q, h_q) - s(v_q, h_p) > \alpha$$

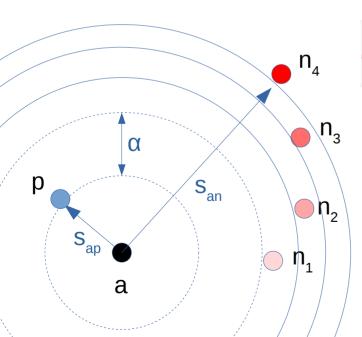
Problem:

treats candidates in a bipolar way.

Goal:

leverage the continuous relevance degree and learn coherent embedding space.

### Ladder Loss



$$>\alpha_1$$
  $>\alpha_2$   $>\alpha_3$   $>\alpha_4$ 

$$s(i_q, t_q) > s(i_q, t_{n1}) > s(i_q, t_{n2}) > \dots > s(i_q, t_{nl})$$

$$s(v_{q}, h_{q}) - s(v_{q}, h_{i}) > \alpha_{1}, (i \in \mathcal{N}_{1}^{-q}),$$

$$s(v_{q}, h_{i}) - s(v_{q}, h_{j}) > \alpha_{2}, (i \in \mathcal{N}_{1}^{-q}, j \in \mathcal{N}_{2}^{-q}),$$

$$s(v_{q}, h_{j}) - s(v_{q}, h_{k}) > \alpha_{3}, (j \in \mathcal{N}_{2}^{-q}, k \in \mathcal{N}_{3}^{-q}),$$

$$\cdots,$$

Ladder Loss

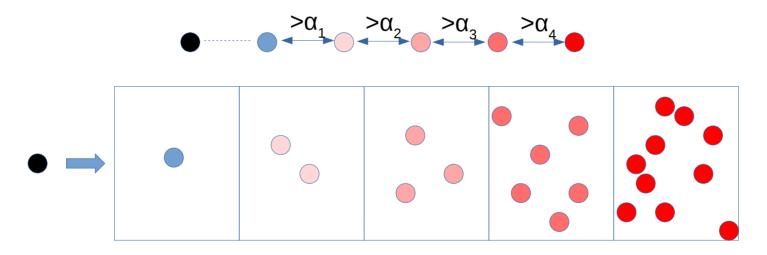
$$L_{lad}(q) = \beta_1 L_{lad}^1(q) + \beta_2 L_{lad}^2(q) + \beta_3 L_{lad}^3(q), \qquad (6)$$

$$L_{lad}^1(q) = \sum_{i \in \mathcal{N}_{1:L}^{-q}} [\alpha_1 - s(v_q, h_q) + s(v_q, h_i)]_+,$$

$$L_{lad}^2(q) = \sum_{i \in \mathcal{N}_{1}^{-q}, j \in \mathcal{N}_{2:L}^{-q}} [\alpha_2 - s(v_q, h_i) + s(v_q, h_j)]_+, (7)$$

$$L_{lad}^3(q) = \sum_{j \in \mathcal{N}_{2}^{-q}, k \in \mathcal{N}_{3:L}^{-q}} [\alpha_3 - s(v_q, h_j) + s(v_q, h_k)]_+,$$

Hard Contrastive Sampling



Number of inequality chain: combinatorial explosion.

### **Coherent Score**

Ground-truth:

Model output:

(How Coherent?)

- \* Traditional performance metric Recall @ K: Only cares about the rank of
- \* Coherent Score: Kendall's Ranking Correlation Coefficient τ

## Experiments

- MS-COCO (120k images, each with 5 annotations)
- Flickr30k (30k images, each with 5 annotations)

BERT STS Acceleration

CBoW < threshold → relevance degree (coarse)

CBoW > threshold → relevance degree (fine)

Hybrid model with threshold set to 0.8 achieves 0.79 in pearson correlation on STS-B.

## Visualization $(T \rightarrow I)$



### Visualization (I→ T)



### VSE++:

A herd of elephants on the grassy plains. A herd of elephants standing on the side of a grass covered hill. Large group of elephants with men dressed in blue riding them. An elephant drinking water while the rest of the herd is walking in ... A aroup of men riding on top of elephants. A large elephant is shown walking through the terrain. A group of four skiers posing for a picture. An elephant standing on top of a lush green hillside. A cluster of small boats in shallow water. A herd of cows is in the meadow. a pair of elephants with their trunks entwined Zebras and wort hoas living together on the plains. three black cows are standing in a field A group of stuffed bears are arranged in a display. a variety of old school show cars lined in a row a long buffet length table covered in many dishes of different foods cherry tomatoes and various food dishes on a table top there are many cars that are waiting for the light to turn green Three plates of toasted sandwiches are on a counter. A compact car is parked beside many motorcycles. Three pizzas are sitting in the windows a small red car. There are two toilets and a sink in this bathroom. A gray couch sitting on top of a rug in a living room. A living room is shown with tables and seating. An elephant stands near water and a stone wall. A busy intersection filled with traffic under traffic lights. Three zebras stand camouflaged in the wide open plains. Four giraffes are standing in front of a small puddle. Many cars in a desert area with planes in the back.

A living room with ample lighting from windows and lamps and brown ...

### CVSE++:

A herd of elephants standing on the side of a grass covered hill. A herd of elephants on the grassy plains. An elephant drinking water while the rest of the herd is walking in ... Large group of elephants with men dressed in blue riding them. A large elephant is shown walking through the terrain. An elephant standing on top of a lush green hillside. A group of men riding on top of elephants. a lawn cut out of a big elephant in a yard outside A herd of cattle is shown in an open field next to a river. An elephant stands near water and a stone wall. An elephant with a red cloth over it. a pair of elephants with their trunks entwined Four airaffes are standing in front of a small puddle. Zebras and wort hoas living together on the plains. a number of cows in a field near a tree A man on a horse corralling a herd of cattle. three black cows are standing in a field A group of birds drinking from a puddle Many sheep and goats cross a road between grassy fields. An elephant walks behind another elephant holding it's tail with it's ... A couple of animals that are in the grass. there are two very tall giraffes that are in the wild A herd of cows is in the meadow THREE ZEBRA ARE STANDING TOGETHER IN THE OPEN LAND Men on horses are driving many other horses in a group. A group of stuffed bears are arranged in a display. Horses walking in meadow with trees and buildings in background. Two red and white cows in a pasture with a pond. Several cows standing in a row on a large open farm. A couple of bears sitting on a coach, one is holding a book.



### VSE++:

### a pizza is sitting next to a salad

Three pizzas are sitting in the windows a small red car. Two photos, each with pizzas, one ham and cheese, one supreme. A black pan holds several small, cooked pizzas. A pan filled with meat and vegetables cooking on a stove top. A slice of pizza with a bunch of vegetable toppings A pizza and tea kettle sitting on a stove. the pizza has cheese, tomato sauce, and olives A pizza with two slices missing from it. a person is eating a pizza with a fork A homemade pizza is waiting to be cooked. Two pieces of bread with sauce on them next to a bowl of chicken ... A thin crust pizza is topped with olives and onions. This meal has beans and three slices of pita bread. a fresh baked pizza with pipina hot cheese A woman puts spices on a skillet of food that is cooking. an image of two people on skiis going down the slope A person cutting a pizza on top of parchment paper. A white plate topped with a vegetables salad. A herd of elephants standing on the side of a grass covered hill. An arrangement or orchids and greenery in a flower pot. A loaded open sandwich at a dinner table. A plate with a hamburger and a salad on it a hot dog topped with tomatoes and peppers with a side of fries there are many fire trucks and=f fire cars in this garage A child's bedroom has plenty of storage space and a small chair. A toilet is in a tiled bathroom with a large window looking out on ... Man about to bite into hot dog with many toppings. Several buses and cars sitting at a traffic light on a road. A kitchen with a stove, microwave, telephone, table and chair.

### CVSE++:

### a pizza is sitting next to a salad A black pan holds several small, cooked pizzas.

Two photos, each with pizzas, one ham and cheese, one supreme. A homemade pizza is waiting to be cooked. A pan filled with meat and vegetables cooking on a stove top. a fresh baked pizza with pipina hot cheese the pizza has cheese, tomato sauce, and olives Two pieces of bread with sauce on them next to a bowl of chicken ... A slice of pizza with a bunch of vegetable toppings A thin crust pizza is topped with olives and onions. A pizza and tea kettle sitting on a stove. Three pizzas are sitting in the windows a small red car. A pizza with two slices missing from it. a person is eating a pizza with a fork A very tasty looking dish with some broccoli and other items. A plate with a hamburger and a salad on it A person cutting a pizza on top of parchment paper. a meat dish with broccoli and peppers on a white plate A white plate topped with a vegetables salad. Two meat sandwiches with potato salad on a white plae A woman puts spices on a skillet of food that is cooking. A loaded open sandwich at a dinner table. A plate of hotdoas, lettuce and tomatoes next to a cup of beer. a table with many different vegetables and fruit A metal platter topped with fish and vegetables. A simple meal of chicken and a large serving of broccoli. Two small trays filled with an assortment of food items a cheese pizza cut into slices on a table This meal has beans and three slices of pita bread.

cherry tomatoes and various food dishes on a table top

## Experiments: MS-COCO

MS-COCO (1000 Test Samples)														
Model	Image→Sentence							Sentence→Image						
Wiodei	CS@100	CS@1000	Mean R	R@1	R@5	R@10	CS@100	CS@1000	Mean R	R@1	R@5	R@10		
Random	0.018	0.009	929.9	0.0	0.3	0.5	0.044	0.005	501.0	0.1	0.5	0.9		
VSE++ (VGG19)	0.235	0.057	5.7	56.7	83.9	92.0	0.237	0.057	9.1	42.6	76.5	86.8		
CVSE++ (VGG19)	0.256	0.347	4.1	56.8	83.6	92.2	0.257	0.223	7.3	43.2	77.5	88.1		
VSE++ (VGG19,FT)	0.253	0.047	2.9	62.5	88.2	95.2	0.246	0.042	6.5	49.9	82.8	91.2		
CVSE++ (VGG19,FT)	0.256	0.419	2.8	63.2	89.9	95.0	0.251	0.287	5.3	50.5	83.6	92.8		
VSE++ (Res152)	0.238	0.079	2.8	63.2	88.9	95.5	0.236	0.080	7.3	47.4	80.3	89.9		
CVSE++ (Res152)	0.265	0.358	2.8	66.7	90.2	94.0	0.256	0.236	6.1	48.4	81.0	90.0		
VSE++ (Res152,FT)	0.241	0.071	2.4	68.0	91.9	97.4	0.239	0.068	6.3	53.5	85.1	92.5		
CVSE++ (Res152,FT)	0.265	0.446	2.4	69.1	92.2	96.1	0.255	0.275	4.7	55.6	86.7	93.8		
		'	MS	S-COCO	(5000 T	est Samp	les)	'						
Model	Image→Sentence						Sentence→Image							
Wiodei	CS@500	CS@5000	Mean R	R@1	R@5	R@10	CS@500	CS@5000	Mean R	R@1	R@5	R@10		
VSE++ (Res152)	0.227	0.078	10.6	36.3	66.8	78.7	0.224	0.084	30.9	25.6	54.0	66.9		
CVSE++ (Res152)	0.253	0.354	9.7	39.3	69.1	80.3	0.246	0.239	25.2	25.8	54.0	67.3		
VSE++ (Res152,FT)	0.231	0.073	7.7	40.2	72.5	83.3	0.228	0.073	25.1	30.7	60.7	73.3		
CVSE++ (Res152,FT)	0.255	0.439	7.4	43.2	73.5	84.1	0.242	0.280	18.6	32.4	62.2	74.6		

Table 1: Comparison between VSE++ and CVSE++ in terms of CS@K and R@K on MS-COCO.

# Experiments: Flickr30k

Model		Ima	Sentence→Image									
Wiodei	CS@100	CS@1000	Mean R	R@1	R@5	R@10	CS@100	CS@1000	Mean R	R@1	R@5	R@10
Random	0.02	-0.005	988.3	0.0	0.3	0.4	-0.033	-0.003	503.0	0.2	0.6	1.1
VSE++ (VGG19)	0.116	0.139	18.2	40.7	68.4	78.0	0.115	0.124	26.9	28.7	58.6	69.8
CVSE++ (VGG19)	0.129	0.255	16.4	42.8	69.2	78.9	0.127	0.144	26.4	29.0	59.2	71.1
VSE++ (VGG19,FT)	0.128	0.130	14.7	44.6	73.3	82.0	0.125	0.110	22.8	31.9	63.0	74.5
CVSE++ (VGG19,FT)	0.133	0.260	13.0	44.8	73.1	82.3	0.131	0.160	20.8	33.8	63.9	75.1
VSE++ (Res152)	0.126	0.127	10.2	49.3	78.9	86.4	0.115	0.112	20.0	35.9	65.9	75.6
CVSE++ (Res152)	0.133	0.247	9.3	50.2	78.8	87.3	0.120	0.147	20.0	37.1	66.9	76.4
VSE++ (Res152,FT)	0.130	0.122	7.8	54.1	81.0	88.7	0.122	0.114	16.2	39.8	70.0	79.0
CVSE++ (Res152,FT)	0.141	0.273	7.4	56.6	82.5	90.2	0.126	0.172	15.7	42.4	71.6	80.8

Table 2: Comparison between VSE++ and CVSE++ in terms of CS@K and R@K on Flickr30K.

# Discussion: Balancing Factor

Bo		Ima	age→Sente	nce		Sentence→Image							
$\rho_2$	CS@100	CS@1000	Mean R	R@1	R@5	R@10	CS@100	CS@1000	Mean R	R@1	R@5	R@10	
0.0	0.238	0.079	2.8	63.2	88.9	95.5	0.236	0.08	7.3	47.4	80.3	89.9	
0.25	0.265	0.358	2.8	66.7	90.2	94.0	0.256	0.236	6.1	48.4	81.0	90.0	
1.0	0.266	0.417	3.9	64.0	88.2	93.1	0.259	0.264	6.2	47.4	79.0	88.9	

Table 3: Performance of the proposed CVSE++(Res152) with respect to the parameter  $\beta_2$  (On MS-COCO dataset).

# Discussion: Scope-of-Interest

T	Image→Sentence								Sentence→Image							
	CS@100	CS@200	CS@1000	Mean R	R@1	R@5	R@10	CS@100	CS@200	CS@1000	Mean R	R@1	R@5	R@10		
1	0.238	0.188	0.079	2.8	63.2	88.9	95.5	0.236	0.189	0.08	7.3	47.4	80.3	89.9		
2	0.265	0.252	0.358	2.8	66.7	90.2	94.0	0.256	0.253	0.236	6.1	48.4	81.0	90.0		
3	0.267	0.274	0.405	3.2	65.7	89.3	94.1	0.261	0.258	0.244	6.3	48.4	80.3	89.4		

Table 4: Performance of the proposed CVSE++(Res152) with respect to the ladder number L. (On MS-COCO dataset)

### Conclusion & Future Work

- Continuous Relevance Degree
- New Ladder Loss Function for Coherent Embedding
- Coherent Score as performance metric
- Our method → Coherent Visual-Semantic Emb Space

Future work: Extend to other metric learning apps.

# Thanks!



Figure 2. Comparison of the sentence-to-image top-30 retrieval results between VSE++ (baseline, 1st row) and CVSE++ (Ours, 2nd row). For each query sentence, the ground-truth image is shown on the left, the totally-relevant and totally-irrelevant retrieval results are marked by blue and red overlines/underlines, respectively. Figure best viewed in color.



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The one il or rather than present to have once cream on it The end and white cover is a parties with a pend. A blue and yells with an parting under a large two with factories in ... A discret picture it a breache for getable toppings A a map of their days proper by a partiery.



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a couple of motion are in a field

### CVSE++:

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A white place is provided to any enables sale of
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musty prophe on a boach with many time flying to the sky.

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A group of people flying their lates in the sand by the econo. A manufactured logicol a smooth brand's other one or A clear radies (fer as light above the tracffe, power lines of usual phonor to come tall find all on a Amenorakia danga kitral.

### CVSE++:

The diplayane in filled with a seriors of different belong desire ... Six worse aloud disought must also made be being that you 'Vanishy of along finishs in business of the communities in Alterediantics control about the death The eric above fiverious daughteurs with weist cappings from of daughteur with a level of display of in a defix band. The small tray of Bedwith an assertment of their its on. The density covered in class slate of things one plate. A digod disalteurrhar lesing on engi-litdoughout sitting matter court phone. A couple of lands on this one is also be delay feed in them. Her days and cheeckings finds retailing on one them. These picture are officially in the relationship of an artist. A group of outfield leads are arrange diss a display. that tide file att to dead dieke. al couples for longith with cone and in many deliver of different fit of a. The demonstration that class care for display.

Different types of the contains and cold distributions over its a chap.

Totally beging a market on the contains. Folly bears of rathin a lit updisplay case, this is have been turned into it of the action conditioners. Time places of too sted candividues are as a counter. A tray that last surface plates, with surface the di-cherry towarders and surface that deliver on a table up. A black pureful discoveral could, cooked picture. Small metal grill mills accommente fice like being a derend, a ona il opusir fle d'et and oil ling bananas Different cand or and treate line the interfer of a switcase. A man in a grown list is noting a dougline. place of hox days and other food A candrach over a best ill edividing one type of fruit



The base bull player is naming for the bull asset on distort drill bles a bull down a field ik odali playen propare terract te apitch. counts officer bell of common on our or the field aco speciafo de persona e persona e est en tra forca: absorbed i player en a field seith a glose A bandadi playing severing ac at de rematten absorbed i field: A couple of men on a field of existal work bandful I. The base runner has taken off as the base man naite for the ball. abanted player on the pix less mound.
Alfo-sized natoriques of abanted player, mid-swing A man with a bat starting at a ball coming towards like. A and so wine in adversarial convey that. proper band of players playing be whell one band of field world I player with a but gits mady to not a pitch Appropriate and appropriate an Alterelal player growady to many at the ball. Allegabell of the courts of conclusion part surplies despited or ma-A gay math the turn or he watches another dutable order.
Also had been as the watches another dutable order.
Assimilary de grands or extent on order by experienced order. Although and relate sight that result "more set perforable about Assessment and security for object black bouting but The signal of the discrease and bright is showing given. Affected amounts an attached right-baseing a telesc. A man redicine to the rate with an umber Sc. Accelle the tretti e did loid tenane canda plane of white ... Authoritie is fit the bill offers on A death added busparted out to about building.

A place of handing, letters and temation or to a cup of beet. tion legal being partfolly, own in efficial area

### VSE++:

people surfling and getting mady to surflin the victor A groupe (people are carfing in the assets natur. A carfir on a perfective at it breaks a persone is carfinar did they are assets A marrow riding a morthward before or any person on a surfle-and riding a succe. A fution and can ride name while using abody based in the ecous.

A our offset is smalling an assurfaceral in the water. Appendix on a sufficient in the serviout of dings national or of a sufficient. Amen d'doce seus corres d'e caribe aré Dusk out in the economisting arrange on his surfloand. A surfly ridings name on the costs. A men pleas in the wayer errite basels men water driling uning a single old A group of people in set mate set to confluends one is act. The confine an personaling in the cosmosth life of Aman stabling a carrier and while stration sections. Group of arrives nation growers the water at sundones. Four boys nationages a feath with their surfleands. Amen is nidines ourleand an environ A normal nice or the stimulation covers on a cabinet most role of dr.
Ne or the out, a man six bandhed over on his beard. The protylittle girls laying in bud next to each regetive. There are not negletive and ingerited girl for through an open field. A family making a color together in the littless. Men in Black shorts in yellow vectoriting on disthe latter of the not reach other and de-



A count of a coffee basis that have each or the sea. weging the stand next rea neadenfonce in an enclosure. h matter and for buby wants a group of a suffer in a new enclosure a girdff standings lose to a feet a skill a people stand around A graffe stick matte boad over a finor tive a sefecto an endourse on a name day. The beade for gint for reading out the rangue near a small bay. A giraffe drinking from a both ein finet of a group of people. equiraffic examining side by side at a zee to floor of a large city. A graffe standing next to a pile of racks and atree. weboats in the harbor in france for bridge sound rates on sixting year a new eating that. A lady is officing on a lover liber of court relate uning her places.

A summer laters on a benefits talk across damp's benefit her. There is a consumer other consent extends in ones. A child with a lither opinio to the offering thad to an adult a couple of arrival care laying in a pro Two birds of ting on a table most rankley jury, a directly leaving over all the tiny time. a giraffi standing in floot of annual floor o A giraffe le did ny fire final between large racks. A could are fet for middle by inside a ferme. A couple of necron string not resuch other looking at aphone. Two worses sufficing drawing that y great curreing benging a cethod board A Asian gold in a publisher helding a netherodo of True women are willing lamana on the sidewolk. A grasp of bioloperde done power live not to a tree, two littles stringene remain is a chair.



a couple of basebull players are out on the field. The basebull player is receiving the the fit. The base recover has take out of as the basebus models for the ball. a brodell deserve of all doors as less A couple of two on a fiel aplaying beneful. a accor player dribbles a hell downs field.

A basefull player within cattler's unit watches during a game.

A 18-stand was figure of a basefull player, wid-oning. A man with a benerating and helf coming to words him. Bandul Tolgym perpens to mart to a pitch A househall playing neutring a cardient exist on a benefall field a benefall player on the plathers reasond a group of benefall players playing booksil on a benefall field. Apticher in a bandle II game pathing about he E. A payments his turners he service a metter distribut A baseball placer and manufactoring at the ball. a baseled player with abangers wadyness expitch The first base couch number as one of his players is up or but. a processinging a brotal but at absorbed I Absorbed player is avinging at a pictururing a game. A qui walding to bit rile bell of a raw A shirtless own suith a bear hell but being pitched to. A bay helding a nigre altered all in a heartful out: A man playing buished it indiding a barrolists a cross-describe.

A man manging a bandadi barrolist playing bandadi game. The barrer candle cand plane unspire are fixed on the pixther. A young woman sitting on the bleechers with a bell Player rating owing at hell with unpite standing behind catcher ... Advice thing read to licks soon hell.

### CVSE++:

A group of people are carding to the oce and name of people sarying and getting ready to our first its name. A surfer on top of sugar as it brooks A person riding a surfleand in the econs A person acre methodel in the server A person and complete in the native.

A fifther and contride waves while unsings body board in the assets.

Dude out in the assets ridings name cells is sufficient. A person one surfluent riding evene. a person on a surfibernés d'un on a surve A nen ridinga nesa on tipofa cufboard. A nen ridinga nesa on tipofa sufboard. A new there's strong to one perfected in the news A serfer ridings were on the ecoan. A sign is riding countered on a same The surfers are parent first in the core on with later.
Group of surfers well-ing in the core on with later.
A new rubbings and board while one flow watches. A men were olding uning good edit. Some people native scaling on a faller and a feet.

A soungers of jumping site of the native 
Kear the surfacement of a functive over on his beaut. A man plays in the nation at the beach The surfive are sufficing entire beach at sight A group of people in sectionity without the orders about their confluence. Three people of time on absence location of the open Four guy are having a good time membranding. A flux young people on a dividage faving after of flux.

People are pure-calling in the name most tills downline; a city ...

We wan in a blue distracted black others knowling beside a maybe and.



Two gias flow crandowers to according free in an end ones. Another of girdfy a being find by an after at the nac. A couple of girdfy is bring free by an after at the nac. A smaller and for he by watch agroup of girdfy is in according to grant grant and on the nace of the property of the nace of the nace. A gird B cric ling its lead over a fence. The gird B circle medicate on a many day. True aim for manding side by side at appeal of your of alarme the The boad of a gird p reaching out to trop to se at a small be you a gird for standing in front of a mend finds a count of animals are laying in april a coupt of animate are beying in a period.
A gradiff derinking from a buttle in from of a groupe (people.
A gradiff I coking for food between large in clos.
A gradiff it can be seen to a pile of roofs a soda to it.
A gradiff it can be seen animaling or or building and froce. There is a covered other asserted entireds in a pers.
A condignistly that on the brins of a bone.
A buby pirith cannot get the above penning of affect in capitalty. Four girdfs are standing infract of a soud i puddle. true aira fe cannel og in anopen montre come ter er a graffe bankspow a little rinytree A Asian girlin a pisk shirt heldinga u threed out. An old rubbitetha bear sitting of in pofa herdi. Le ditingatio record holding an undrell athrough an iron fince. So would coun standing in a review to large upon farm.
A clid dwell allob at a pione table of principles dream while
A cline up of a sort lackling attracted in g.
The trace gridfle a are transling regettle by the trace.



A men after bitting attentional for the court a trensic player criticaling to little ball a secont player drillable abuil above a field t secure program at these a trust convert a price to become proported for so client to his trust lie fill. In person codinging a confided liber and lietting a confided to h and recipe a service bellery and our perior to come A man not his about starting at a bull coming towards being A solub governapple sitting in the origin of an disciplant a man coinging a but solub environmental absorbed. A girl getting mady to lich one ow hell. Various fluit on an a counter court of are cortains.

Founds troops also ser lumges forms of all ming to but the ball. A name of the experience on mange a late a child manging about at abid!

A life-size developing about of a basehold player, mid-mang. Meaning strong of legituring types out the court. A pole recent a searing ables plant a bank librar. a man is offring to first of absence of fruit.

A strong parts also de partie d'un a a dissollé se et a strong. Young no own are playing occur with a norman going after the ball. Nem nittark starre in yellow sect settings only is.

A person starred of an embod die the ratio A ugo in agreen that is noting a disagletes.

A ugo in agreen that is noting a disagletes.

A reasonable self-instruction to all empty track. a personning ing a bay hall be rat aband-aff A men everying a be sole II but while playing benthal game.
A couple of times on a field playing bands I. the loss have been turned into high the public and inventors. A lapse promption, and phones and bananas on the salide



### VSE++:

A cide control in guestry bears souther special A sandwick grape, and care to sitting an aplate. a journal, natisheds, laye, bask and backpack on a being courch. Of fewer, could be and treated like the interior of a suit laye. Acouple's fringe lit or aboarb. Accepted group at an about.

About of a militrative authority certian is no accepted a laying of material acceptance of a title and control acceptance of a title and control acceptance of the transcent display. Small netal grill with accommental continuity a direct.

A blue and white to still read and no diparts and site if A manneyaring equilation, a coard and the on a melifie phone. White brokened in the large close is to on it. A meter cycle riding methy server such 4% on the Birk. A person reaching out and cutting a calle.

A disc of picta with a banche fulgerall e toppings.

A decortwith class late and because slices of a set a plane. his and his Samu Class durating on the old of a read at Samu point. There emfod have laying an abod merror a sufferfree. As less upofiting collectinging her soften. A blue plate of the organize contains for fined on it. A small place of pizza and some too.
The pizza has cheese, constructed accept, and divise Assiste board floor with larger digital or A metal plant rapped of the fichand separation. a could use withinking foreign strike. The latter, cardier, and plate copies are fixed on the pixther. Adop is rearring a party lattered troughts. Many decentions language of recreif the backs A manproving between on his cell plane. A red and while has driving down a greet.



### VSF++:

e descriptions when the followings Group of Johns counding a mand growing each other A couple of Johns ore no liking through unidergrowth. THREE ZIEGN ARE STANDING TOGETHER IN THE OWN LAND ne prime face each other and graze as openfield A single of palms one groups fold. Three artest stand connectinged in the with operaplains. Three artest walking a straight line through an operaplain. a clase upo fa mirror classing two zebras. A class speciments a street in a decort. some arbital literal og discentare at some grans THE REAL PROPERTY OF THE PARTY THE FELD. Zebras and senting diving a getter active plains The protty little girls laying inhydrout to so disagether. The larger with blaze or other faces muching as disting The employ stary lading at each ather's phones. A child laying incorbovith raidy lead a series of different description of the plant description from A carrie ladeing does not the convex, with morthy in the background. the Outpublishing lacency of five or colors and A couple of animal offset are in the grass. the pixe has chosen to make nation, and divest A makened if frames with oray and discribing color Zobra our alone by the bush in doing the converting to our Action up of a soil in during at convelling. the lapupe sixing native arbitraria and abid. A man in a sed and gel drie looking playfully about.

A toddy boar withat singley flavolating page for the cheers in he d. Two photos, each with pictus, a selban and choose, one supreme. A write band filled soft lars of chorries.



Amena for litting a round ball on the court a trends plage a stretching to let a hell Aperon svinging anythold became bitting anythold.
Attends propered by racket to bitting left. Aguy tending arrent's hall upon preparing teneror. A manpleying trees or strate and meaning and start, a childrening or at let at aball. a country the best area and consequently best a second play with the country to t Laborat still a gript shifter sets proposed a Female remis player longes fleward aiming to little half. a close up of a to this player with analyst. a tennic player mu court with anador. A woman chinging at most suidet standing enous lay. The benefic liphy or in running for the bull

A liph-stand not a figure of a books lipha are, or of coding.

A maximal inging a be or full librarish to playing basebull game. a person one og ing a baseball betæte be sebell A baseful player gett mady to owing at the fall.

Menoportuning sufficiently to prove partition out. A girl getting ready to lick a necor ball. A inacinvaring a list left dug at remit nat guet. A baseball player is covinging at a pixth distring against. A girl teatring to bit the ball of for a tea. A couple of show on a field playing be orbs II. A transic player on the court decord in pick.

A bandual playing nearing a cardiers entre on he relief field.

Player is into average at half with unprive transling behind cardier... A manifolding matter remaining to temperature.

A resemble standing one to mis court lielding a recognit.

### CVSE++:

A cale covered inguismy beat out the green.

Different candles and route line the interior of a suitone. A nambalds, guipes, and carrent sitting an aplant. A class up of three calles singing best of thes.

A click of protection a bunch of segments on prings A conditionary of property operators A person washing our and our fine a calle. A few diced of a lise pieza of ting on a will to plate. a designly matrixitioners may reprint of our of a Administration of the same discounts and plane. a discretifier controller and sent non other (pose on a three is a conditionally pictor that is on a small place The name decorated a calle to lock like a vision from Decorable No. Arthin crust pizza i crapped selfe di nec and enime.

A young bey be also a direct with select procing and sprinkles. A writer bowl filled seth lets of chemics the pizarbas chees, remate cases, and dises a couple helding along trapether as the year acable Sing I word grill with accomment of coding being a drowd, a present is all ing a pitter with a first Heavy decreasions being injury infrast of the board. This word has been aid three dions of pital broad. Parawill sauce and regendles on aplate. The plotter, each will pitting one last and closes, one supreme Apitte and the lettle offing our carse. cherry tangens and various the did likes on a table top-A bothery cally fix a one-year a liftfort lies abid yelds bear on it. There are many hid out a party where there is calle a de es atos outiste dices en atable. An arrangenest of oil we getables to a cutting learni.

### CVSE++:

Company before counting are and greening each other a clear upon far mirror clearing the others. THREE ZERION ARE STANDARD CONCERNED IN THE OPENIC AND A class up clara fa zelra in advort. A couple of zelras are no liding through undergrowth. Two primar face out to other and array as one of left A group of solves one gracey field.

come solves busing directive at come grace. There are realizing a straight for through an openfuld. There are no countries or the house of the property. Zelea out above by the basis to doing the converting to out THE REAL PROPERTY AND THE PERFORMANCE OF THE PERFOR A fines of a real width are attached to de layering a table. The larges with blaze or other falces next logical charbes A class up of a cool ladding at consulting. Alone or bragating on the given grace in a fel d. A couple of desired of that are in or being seen. a pair of depletes with their tracks constand. There are followers bying no absolute to a stuffs of m.g. A girdfe and solve a and ingrear a building and fines. A bully call formal belong some gathered bay.
A large black and brown be at proping in the staff flor cape is: e leade for graff marking out distangue over a conflict. A death photograph for of an aniversing a red and white stoped that The white and red his desire protive laws. The wide hears with stoped dotts at on the passeness. A carrie lasking deserous the careers, with another certical adaptment.