MAVias: Mitigate any Visual Bias

Supplementary Material

1. Theoretical Justification

1.1. Impact on Gradients

Let us consider a bias-aligned $\mathbf{x}^{(a)}$ and a bias-conflicting sample $\mathbf{x}^{(c)}$ with targets $y^{(a)} = y^{(c)} = \kappa$. The logits produced by $f_{\boldsymbol{\theta}}$ and $g_{\boldsymbol{\phi}}$ for each class $k \in \mathcal{Y}$, are then $\mathbf{z}_{\text{main}}^{(a)}(k)$, $\mathbf{z}_{\text{main}}^{(c)}(k)$, $\mathbf{z}_{\text{tag}}^{(a)}(k)$, and $\mathbf{z}_{\text{tag}}^{(c)}(k)$, respectively. $g_{\boldsymbol{\phi}}$ encodes visual bias, being irrelevant to class κ, thus we expect $\mathbf{z}_{\text{tag}}^{(a)}(\kappa) \gg \mathbf{z}_{\text{tag}}^{(c)}(\kappa)$. Also, bias-aligned samples that contain shortcuts are easier to learn by $f_{\boldsymbol{\theta}}$ and therefore it is expected that $\mathbf{z}_{\text{main}}^{(a)}(\kappa) \geq \mathbf{z}_{\text{main}}^{(c)}(\kappa)$. These imply:

$$\begin{aligned}
&\mathbf{z}_{\text{main}}^{(a)}(\kappa) + \mathbf{z}_{\text{tag}}^{(a)}(\kappa) \gg \mathbf{z}_{\text{main}}^{(c)}(\kappa) + \mathbf{z}_{\text{tag}}^{(c)}(\kappa) \Rightarrow \\
&\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)}) \gg \sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)}) \Rightarrow \\
&\frac{1}{\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})} \ll \frac{1}{\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})}
\end{aligned} \tag{3}$$

where $\sigma^{(k)}$ denotes the kth class' softmax score.

Additionally, $f_{\boldsymbol{\theta}}$ after a few iterations learns bias-aligned samples (based either on relevant or irrelevant class features) indicating $\arg\max_{k\in\mathcal{Y}} \mathbf{z}_{\text{main}}^{(a)}(k) = \kappa$, while $\arg\max_{k\in\mathcal{Y}} \mathbf{z}_{\text{tag}}^{(a)}(k) = \kappa$, by definition. Hence, $\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)}) \approx 1$ leading to diminished gradients $\frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)}+\mathbf{z}_{\text{tag}}^{(a)})] \approx 0$. On the other hand, $\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)}+\mathbf{z}_{\text{tag}}^{(c)}) \in (0,1)$ leading to gradients $\frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)}+\mathbf{z}_{\text{tag}}^{(c)})] > 0$. Hence:

$$\frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})] \leq \frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})] \tag{4}$$

Combining Eq. (3) and Eq. (4) we get:

$$\begin{aligned}
&\frac{1}{\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})} \cdot \frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})] \ll \\
&\frac{1}{\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})} \cdot \frac{\partial}{\partial\theta_0}[\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})] \Rightarrow \\
&\frac{\partial}{\partial\theta_0}[\log\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})] \ll \\
&\frac{\partial}{\partial\theta_0}[\log\sigma^{(\kappa)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})] \Rightarrow \\
&\frac{\partial}{\partial\theta_0}\left[\sum_k \mathbb{1}(a,k)\cdot\log\sigma^{(k)}(\mathbf{z}_{\text{main}}^{(a)} + \mathbf{z}_{\text{tag}}^{(a)})\right] \ll \\
&\frac{\partial}{\partial\theta_0}\left[\sum_k \mathbb{1}(c,k)\cdot\log\sigma^{(k)}(\mathbf{z}_{\text{main}}^{(c)} + \mathbf{z}_{\text{tag}}^{(c)})\right] \Rightarrow \\
&\frac{\partial\mathcal{L}^{cls}(\mathbf{x}^{(a)})}{\partial\theta_0} \ll \frac{\partial\mathcal{L}^{cls}(\mathbf{x}^{(c)})}{\partial\theta_0}
\end{aligned} \tag{5}$$

where

$$\mathbb{1}(i,k) = \begin{cases} 1 & \text{if } y_i = k \\ 0 & \text{otherwise} \end{cases} \tag{6}$$

which indicates that through our framework, the main model $f_{\boldsymbol{\theta}}$ is enforced to update its weights based mainly on the gradients corresponding to the bias-conflicting samples $\mathbf{x}^{(c)}$. This essentially means that $f_{\boldsymbol{\theta}}$ will eventually ignore the visual cues prevalent in $\mathbf{x}^{(a)}$ samples corresponding to irrelevant information encoded by the tag model $g_{\boldsymbol{\phi}}$.

1.2. Unbiased Distribution Learning

Let $p_{tr}(X, Y, B)$ be the training data distribution where X, Y, B are random variables associated with the data, the label, and the bias attribute, respectively. From Theorem 1 of [16] we know that if P_u is a shift of p_{tr} such that the distribution $P_u(Y|B)$ is uniform (and therefore unbiased), then for a model $f_{\boldsymbol{\theta}} = p_u(y|\mathbf{x})$ that estimates the conditional probability over P_u, its probability over p_{tr} will be

$$p_{tr}(y|\mathbf{x}) = \frac{\exp\left(\mathbf{z}_{\text{main}}(y) + \log p_{tr}(y|b)\right)}{\sum_{y'}\exp\left(\mathbf{z}_{\text{main}}(y') + \log p_{tr}(y'|b)\right)} \tag{7}$$

In the case of MAVias, let the probability $p_{tr}(y|b)$ be estimated through the projection and classification layers, $\mathbf{z}_{\text{tag}} = f_{\boldsymbol{\theta}_c}(g_{\boldsymbol{\phi}}(\mathbf{e}))$, which use the visual bias embeddings $\mathbf{e}$ (encoding the irrelevant tags) to produce logits $\mathbf{z}_{\text{tag}}$. As a result,

$$\begin{aligned}
\log p_{tr}(y|b) &= \log\frac{e^{\mathbf{z}_{\text{tag}}(y)}}{\sum_{y''}e^{\mathbf{z}_{\text{tag}}(y'')}} \\
&= \mathbf{z}_{\text{tag}}(y) - \log\left(\sum_{y''}e^{\mathbf{z}_{\text{tag}}(y'')}\right) \\
&= \mathbf{z}_{\text{tag}}(y) - A(\mathbf{z}_{\text{tag}})
\end{aligned} \tag{8}$$

where $A(\mathbf{z}_{\text{tag}}) = \sum_{y''}e^{\mathbf{z}_{\text{tag}}(y'')}$. Replacing (8) to (7) gives

$$\begin{aligned}
&p_{tr}(y|\mathbf{x}) = \\
&=\frac{\exp\left(\mathbf{z}_{\text{main}}(y) + \mathbf{z}_{\text{tag}}(y) - A(\mathbf{z}_{\text{tag}})\right)}{\sum_{y'}\exp\left(\mathbf{z}_{\text{main}}(y') + \mathbf{z}_{\text{tag}}(y') - A(\mathbf{z}_{\text{tag}})\right)} \\
&=\frac{\exp\left(-A(\mathbf{z}_{\text{tag}})\right)\exp\left(\mathbf{z}_{\text{main}}(y) + \mathbf{z}_{\text{tag}}(y)\right)}{\exp\left(-A(\mathbf{z}_{\text{tag}})\right)\sum_{y'}\exp\left(\mathbf{z}_{\text{main}}(y') + \mathbf{z}_{\text{tag}}(y')\right)} \\
&=\frac{e^{(\mathbf{z}_{\text{main}}(y)+\mathbf{z}_{\text{tag}}(y))}}{\sum_{y'}e^{(\mathbf{z}_{\text{main}}(y')+\mathbf{z}_{\text{tag}}(y'))}}
\end{aligned} \tag{9}$$

thus leading to the logit addition of Eq. (1).

For this approach to work, however, one must ensure that models g_{ϕ} and f_{θ_c} are successfully trained to produce logits $\mathbf{z}_{\text{tag}}$ that predict $p_{tr}(y|b)$ and are not dominated by $\mathbf{z}_{\text{main}}$. This is achieved by the logit alignment term of Eq. (2) which controls the magnitude differences of $\mathbf{z}_{\text{main}}$ and $\mathbf{z}_{\text{tag}}$.

2. Experimental Setup

2.1. Prompting

To ensure accurate tag classification, we provide the LLM with a detailed system prompt. Tags are processed in batches of 100, as testing has shown that longer lists can lead to some tags being overlooked. Since relevant tags are significantly fewer than irrelevant ones, we instruct the LLM to return only the relevant tags, allowing us to deduce the irrelevant ones. The exact system prompt is presented in Fig. 4

System Prompt

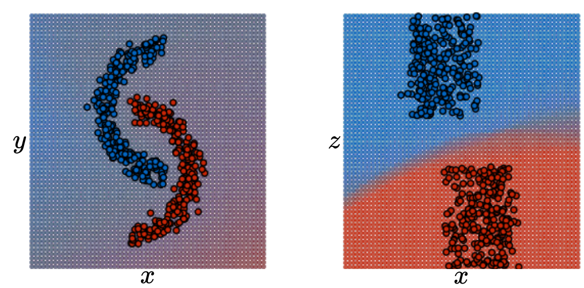
I will provide you with the name of a target class and a large list of tags. Your task is to evaluate the tags and identify only those directly related to the target class. A tag is considered relevant if it describes or is an essential part of the object associated with the class name. This includes tags that refer to: physical components, defining features, inherent characteristics, and essential behaviors or functions of the object.
For example, if the target class is “bee”, tags like “insect”, “wing”, and “buzz” are relevant because they describe core aspects of what a bee is or does.
Conversely, a tag is irrelevant if it refers to elements that are not an intrinsic part of the object. Irrelevant tags may include: background details, environmental context, colors (unless a defining characteristic), lighting, textures, other objects, or other non-essential contextual elements.
For example, in the case of the class “bee”, tags like “sky”, “flower”, or “blue” would be irrelevant, as they describe the environment or background rather than the bee itself.
Please output only the relevant tags in JSON format only (i.e., { relevant_tags: [the list of tags]}).

Figure 4. LLM system prompt for deriving the relevant tags.

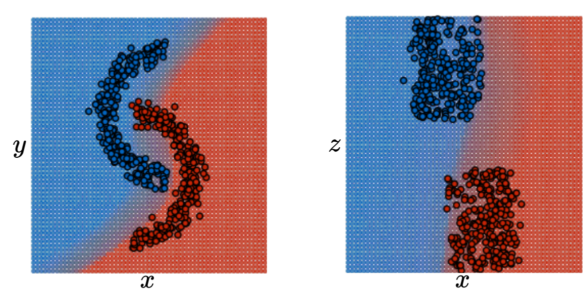
3. Two-moon Distribution Experiment

To demonstrate the capability of MAVias in mitigating biased features, we extend the classic two-moon distribution into a 3-dimensional setting. In this scenario, we consider a dataset $\mathcal{D} = \{(\mathbf{x}^{(i)}, y^{(i)})\}_{i=1}^{N}$, where each input $\mathbf{x}^{(i)} = (x_1^{(i)}, x_2^{(i)}, x_3^{(i)})$ consists of two relevant features $x_1^{(i)}, x_2^{(i)}$ and an additional irrelevant feature $x_3^{(i)}$ that introduces bias. The target label $y^{(i)}$ should be determined based on the features $x_1^{(i)}, x_2^{(i)}$, following the typical two-moon structure, while the feature $x_3^{(i)}$ represents the bias (e.g., samples are linearly separable with respect to $x_3^{(i)}$, even though it should not be used for classification).

In this setup, the main model $f_{\theta}(\mathbf{x}^{(i)})$ receives the full input $\mathbf{x}^{(i)} = (x_1^{(i)}, x_2^{(i)}, x_3^{(i)})$, while the projection layer $g_{\phi}(x_3^{(i)})$ is provided only with the irrelevant feature $x_3^{(i)}$. The projection layer helps the system to explicitly account for this bias by incorporating $x_3^{(i)}$ in a controlled manner, while the main model is encouraged to focus on the relevant features $x_1^{(i)}$ and $x_2^{(i)}$ for classification. As shown in Fig. 5, MAVias enables the main model to effectively learn the underlying two-moon distribution based on the features $x_1^{(i)}, x_2^{(i)}$, while the vanilla model relies only on the biased feature $x_3^{(i)}$, treating it as a shortcut that prevents the model from learning the proper distribution.



(a) Vanilla outputs on axes x and y. (b) Vanilla outputs on axes x and z.



(c) MAVias outputs on axes x and y. (d) MAVias outputs on axes x and z.

Figure 5. Two-moon problem on 3 dimensions. The distributions are linearly separable on axis z (i.e., z feature introduces bias), while the actual target is to learn the distributions defined by the features x and y.

Table 13. Bias-conflict and Unbiased accuracy comparison on CelebA with *BlondHair* and *gender* as biased attribute and target, respectively. Bold denotes the best-performing bias label-unaware (BU) method and underlined denotes the best-performing bias label-aware method.

Methods	BU	Bias	
		BlondHair	
		Unbiased	Bias-conflict
LNL [20]	✗	80.1±0.8	61.2±1.5
DI [48]	✗	90.9±0.3	86.3±0.4
EnD [44]	✗	86.9±1.0	76.4±1.9
BC-BB [16]	✗	<u>91.4</u>±0.0	87.2±0.2
FairKL [2]	✗	81.7±1.7	69.9±2.4
FLAC [41]	✗	91.2±0.3	<u>88.7</u>±0.5
LfF [32]	✓	84.2±0.3	81.2±1.4
SoftCon [16]	✓	84.1	74.4
FLAC-B [41]	✓	87.0±0.6	84.9±2.2
MAVias	✓	**89.7**±0.6	**87.1**±1.7

4. Comparative Analysis

In this section, we compare the performance of MAVias with other competitive methods on closed-set (i.e., predefined bias) scenarios. The reported results encompass both bias-label aware (BA) and bias-label unaware (BU) methods. However, it should be noted that MAVias can be directly compared only with the BU approaches. Table 13 presents the performance of MAVias on CelebA with *gender* as target and the *BlondHair* as the biased attribute. The performance on unbiased and bias-conflicting samples indicates the ability of MAVias to reduce reliance on spurious correlations between the target and the corresponding biased attributes. Specifically, MAVias achieves 87.1% accuracy on bias-conflicting samples, surpassing state-of-the-art BU methods such as FLAC-B [41] and LfF [32], while maintaining high unbiased accuracy (89.7%). Table 14 evaluates MAVias on Waterbirds, a well-known benchmark for spurious correlation problems between bird type and background environment. Notably, MAVias attains 93.7% Worst-Group accuracy, outperforming all compared BU methods (+5%), while slightly improving the average accuracy (+0.7%). The results on UrbanCars in Tab. 15 further validate the efficacy of MAVias in mitigating multiple biases introduced by co-occurring objects and background features. While the in-distribution accuracy (I.D. Acc) of MAVias is marginally lower than that of LfF [32] or Debian [24], it achieves substantial improvements in reducing the BG Gap (4.1) and CoObj Gap (2.4), as well as their combined effects (BG+CoObj Gap: 6.7).

Table 14. Evaluation on Waterbirds.

Method	BU	WG Acc.	Avg. Acc.
GroupDro [38]	✗	90.6±1.1	91.8±0.3
BAdd [42]	✗	<u>92.9</u>±0.3	93.6±0.2
DFR [36]	✗	<u>92.9</u>±0.2	<u>94.2</u>±0.4
JTT [27]	✓	86.7±1.5	93.3±0.3
DISC [49]	✓	88.7±0.4	93.8±0.7
MAVias	✓	**93.7**±0.4	**94.5**±0.4

Table 15. Evaluation on UrbanCars.

Method	BU	I.D. Acc	BG Gap	CoObj Gap	BG+CoObj Gap
GroupDro [38]	✗	91.6	10.9	3.6	16.4
DFR [36]	✗	89.7	10.7	6.9	45.2
LLE [25]	✗	96.7	<u>2.1</u>	2.7	5.9
BAdd [42]	✗	91.0±0.7	4.3±0.4	<u>1.6</u>±1.0	<u>3.9</u>±0.4
LfF [32]	✓	97.2	11.6	18.4	63.2
JTT [27]	✓	95.9	8.1	13.3	40.1
Debian [24]	✓	98.0	14.9	10.5	69.0
MAVias	✓	92.8±0.8	**4.1**±0.6	**2.4**±1.4	**6.7**±1.4

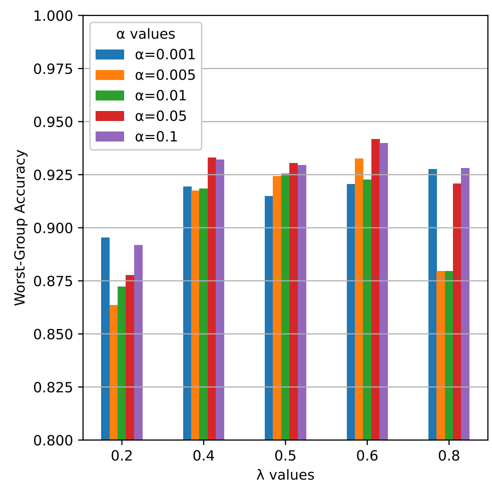


Figure 6. Impact of hyperparameters α and λ on the worst-group accuracy (closed-set protocol) on the Waterbirds dataset.

5. Ablations & Hyperparameter Tuning

Tab. 16 reports the performance of MAVias when computing individual embeddings for each tag and then averaging them compared to the one computing a single embedding for all tags combined. As one may observe, although both are highly effective, the latter can provide more representative features.

Fig. 6 illustrates the impact of different values of hyperparameters α and λ on the MAVias performance. The hyperparameters for all datasets were tuned through the same grid search. Overall, optimal λ values are close to 0.5 -

Table 16. Comparison of MAVias performance on Waterbirds using different approaches for computing embeddings from tags. "separately" denotes computing individual embeddings for each tag and then averaging them, while "collectively" denotes computing a single embedding for all tags combined.

Type	WG Acc.	Avg. Acc.
separately	93.0±0.2	93.6±0.2
collectively	93.7±0.4	94.5±0.4

we noticed that values > 0.5 work better for less biased datasets and < 0.5 for datasets with extreme bias rates. α is a much less sensitive hyperparameter, and any value between 0.001-0.1 does not have a severe impact on the results.

6. Irrelevant Tags

Tables 17,18,19, and 20 report the lists of irrelevant tags for CelebA, Waterbirds, UrbanCars, and ImageNet9 datasets, respectively.

Table 17. CelebA irrelevant tags.

class	tags
non-blonde	3D glasses, Eiffel tower, accordion, adjust, advertisement, alarm clock, album cover, alcohol, amusement park, antler, apple tree, apron, aquarium, archery, arena, arm, army, art exhibition, artist, asparagus, assembly, astronaut, athletic, atm, attach, attend, audi, auditorium, aviator sunglasses, back, backdrop, badge, badminton, balance, ball, ballerina, balloon, bamboo forest, banana tree, banjo, banquet, bar, barbell, barber shop, barrel, baseball, baseball bat, baseball game, baseball glove, baseball hat, baseball pitcher, baseball player, baseball team, baseball uniform, basketball, basketball coach, basketball game, basketball hoop, basketball player, basketball team, bass, bass guitar, bat, bathroom accessory, bathroom sink, batter, battery, beach, beach ball, beach chair, beach volleyball, beaker, beard, beat, bedcover, beer can, beer glass, beige, belly, belt, bench, beret, berry, beverage, bible, bicycle, bicycle helmet, big ben, biker, bill, binder, binocular, birch tree, birthday cake, birthday candle, birthday party, bishop, bite, black, blade, bleacher, blender, blind, blood, blouse, blow, blue, board, boat, bodybuilder, bonnet, book, bookstore, boot, bougainvillea, bouquet, bow, bow tie, bowling ball, boxer, boy, branch, brewery, bride, bridesmaid, bridle, briefcase, brim, broccoli, brooch, bubble gum, building, bull, bullet, bulletin board, bunny, bureau, bus, bush, business suit, businessman, bust, butterfly, button, cabinet, cage, camera, camouflage, can, candle holder, cane, canoe, canopy, cap, cape, car, car door, car seat, card, card game, cardboard box, cardigan, caribbean, carnival, carrot, carry, cash, cat, catcher, cathedral, ceiling, ceiling fan, cello, certificate, chain, chalk, champagne flute, chandelier, chef, cherry, cherry blossom, chessboard, chest, chihuahua, chip, chocolate, chocolate cake, choir, chopstick, christmas, christmas ball, christmas card, christmas hat, christmas tree, church bench, city, city skyline, city street, city view, clasp, classroom, clinic, clipper, cloak, clock, close-up, cloth, clothe, clothing store, cloud, cloudy, club, clutch, clutch bag, coach, cockpit, cocktail dress, coconut tree, coffee, coffee cup, coke, college student, comfort, comic, compete, computer, computer desk, computer monitor, computer screen, concert hall, concrete, condiment, conductor, cone, conference hall, confetti, construction site, construction worker, container, control, convenience store, convention, conversation, convertible, cooler, copy, corn field, couple, course, court, cowboy, cowboy boot, cowboy hat, cream, cricket, cricketer, crochet, crowd, crowded, crown, cruise ship, cube, cup, cut, cylinder, cymbal, dagger, daisy, dark, daybed, debate, debris, decorate, deliver, denim jacket, dentist, desert, detective, diamond, diploma, dirt track, dish washer, diver, dock, doctor, donut, doodle, doorway, dough, dress hat, dress shirt, dressing room, dribble, drink, drive, drone, drum, drummer, drumstick, dry, duchess, dune, dunk, ear, earphone, earth, easter, easter bunny, eclipse, electric outlet, electrician, electronic, emerald, engagement ring, engineer, envelope, equestrian, equipment, evening dress, exercise, exhaust hood, eye, eye mask, eye shadow, eyebrow, face, fair, family photo, fan, fashion model, fashion show, fedora, fence, fern, ferry, fiction, field, fight, figure skater, figurine, file, fill, film premiere, finish line, fish, fishbowl, fishing pole, flag, flannel, flask, flat, flight attendant, flip, floral arrangement, flower girl, flute, fly, foam, foil, food, food processor, football, football coach, football field, football game, football helmet, football match, football player, forehead, fork, frosting, fruit, fruit stand, game, garment, gasmask, gathering, geisha, give, gladiator, glass bowl, glass building, glass jar, glass vase, glasses, glove, goal, goalkeeper, goggles, gold medal, golf cart, golf club, golf course, golfer, gothic, gown, graduate, graduation, graveyard, gray, greyhound, groom, guitar, guitarist, gym, halloween costume, hammer, hammock, hand, handkerchief, hanger, hard rock artist, hardwood floor, hat, hay, head, head coach, headlight, headscarf, hearing, heart, heart shape, hedge, helmet, henna, hillside, hip hop artist, hockey player, hole, honey, hood, hoodie, horse, hospital bed, hospital room, hot, hot dog, hourglass, houseplant, hula hoop, ice cream cone, ice hockey player, icecream, icing, image, infant bed, insect, instrument, interview, ipad, iphone, iron, ivy, jacket, jacuzzi, jar, jaw, jeans, jewel, jewellery, job, jockey, joker, judge, juggle, juice, karaoke, karate, kayak, key, keyboard, khaki, kilt, kimono, kiss, kitchen, kitchen cabinet, kitchen counter, kitchen table, kite, laboratory, lace dress, ladder, lake, lamp post, lanyard, laptop, lash, lasso, laugh, lead singer, leather jacket, ledge, lens, leprechaun, library, license plate, life jacket, lifeguard, light, light switch, lighthouse, lily, limo, liquid, liquor store, list, locker, log, log cabin, logo, love, luggage, machete, machine, machine gun, magnifying glass, magnolia, make, makeup artist, mall, man, mannequin, mantle, mark, martial, martini, martini glass, mask, massage, mat, measuring tape, mechanic, medal, media, messenger bag, metal artist, meter, microphone, microscope, milk, milkshake, mirror, mixer, monarch, money, monk, moped, mother, motorbike, motorboat, motorcycle, motorcycle racer, motorcyclist, mound, mountain, mountain biker, mouse, mouth organ, mouthwash, mp3 player, mud, mug, muscle, music, mustard, napkin, nature, navy, neck, needle, neon, neon light, net, newlywed, news, news conference, nightclub, nose, number, nun, nurse, oar, office, office building, office chair, office supply, office window, officer, open, operate, orange, orange juice, orange tree, out, overcoat, package, paddle, pain, palm tree, panda, panel, paper, paper cup, paper towel, parachute, parasail, parking meter, parrot, party, party hat, pastry, patient, payphone, peach, peak, peel, pen, pencil, pepper, person, pharmacy, phone box, photo, photo frame, picture, picture frame, pigeon, pigtail, pillar, pillow, pilot, pin, pint, pipe, pipe organ, pirate, pitch, pitcher, plaid, plane, plank, plate, play, player, playground, playing card, playingfield, plug hat, podium, point, poker, pole, politician, polo shirt, pomeranian, pop artist, poppy, porch, postcard, powder, power line, prayer, preacher, presentation, president, press room, pretzel, princess, produce, professional, projection screen, projector, prom, propeller, pug, puppet, purple, puzzle, python, queen, race, race car, race track, racket, radiator, radio, raft, rain, raincoat, rapper, razor, read, receive, reception, record player, rectangle, referee, reflection, religious, remote, ride, rifle, rise building, road, robe, rock artist, rock band, rock formation, room, rope, royal, ruffle, rugby player, ruler, run, runner, safety helmet, safety vest, sailor, sake, salon, salute, sand, sandal, sandwich, santa claus, sari, satin, sauna, sax, school bus, scientist, scissors, scoop, scooter, scout, scratch, screen door, scrub, sculptor, sculpture, sea, seashell, seat, seat belt, selfie, service, shadow, shake, shampoo, shape, share, shaver, shaving cream, sheet, shell, shield, shirt, shirtless, shoot, shooting basketball guard, shot glass, shotgun, shoulder, shoulder bag, shower head, sideline, siding, sign, signature, silver medal, sing, singer, sip, sit, skeleton, ski, ski pole, ski slope, skier, skull, sky, sleep, sleepwear, slide, smartphone, smell, snake, snow, snowball, snowman, snowy, soap, soda, softball, soldier, sombrero, sparrow, speaker, speech, speech bubble, spider web, spin, sponge, sports ball, sports coat, spray, square, squirrel, stable, stadium, stage light, stairs, stall, stand, star, stare, steam, stethoscope, stick, stocking, stomach, stool, stop sign, store, strap, straw, straw hat, strawberry, street corner, stretch, string, strip, stripe, student, subway, subway station, subwoofer, suit, sun, sun hat, sunbathe, sunflower field, sunglasses, sunset, sunshade, superhero, surfboard, surfer, surgeon, surgery, suspenders, sweater, sweatshirt, swim, swim cap, swimwear, swing, swinge, switch, swivel chair, syringe, t shirt, t-shirt, table, table tennis, table tennis racket, table tennis table, tablet computer, tackle, take, talk, tan, tape, tassel, tattoo, taxi, tea, team presentation, tear, tee, teething ring, telegraph pole, telescope, television, tennis, tennis match, tennis net, tennis player, tennis racket, test tube, theater, thistle, throne, throw, tie, tiger, tight, tile, tile wall, tissue, tobacco pipe, toddler, toilet paper, tomato, tool, toothpick, torch, totem pole, tower, tower bridge, toy gun, train, train car, train track, train window, tray, treat, tree trunk, trench, tribe, tripod, trophy, trumpet, tub, tulip, turquoise, twig, twist, typewriter, ukulele, underclothes, uniform, vampire, vase, vegetation, vehicle, veil, vessel, video camera, vine, vineyard, violet, violin, violinist, visor, volleyball, volleyball player, waist, wall, wall clock, warehouse, wash, watch, water, water park, waterway, wave, wear, web, wedding, wedding bouquet, wedding dress, wedding ring, wet, wetsuit, whistle, white, white house, whiteboard, wildflower, wind, window sill, windshield, windy, wine cellar, wine glass, winery, winter, witch, witch hat, wood floor, world, wrench, wrestle, wrestler, wristband
blonde	CD, Eiffel tower, Wii, Wii controller, actor, adjust, album, album cover, alley, apron, army, award, baby, backdrop, balustrade, bandage, bandeau, barber, barbie, bartender, baseball bat, bathroom mirror, beach ball, beautiful, beauty salon, bed, bedcover, bikini top, birth, bite, blender, blow, boat, bobfloat, bookshelf, bookstore, bouquet, bow, box, brace, bracelet, braid, bride, bridle, brush, bubble, bust, camera, candy, car seat, cardigan, carpet, casino, cat, catwalk, chihuahua, christmas hat, cigar, city, clip, clock, cloth, clothing store, coach, coat, comb, comfort, convention, cosmetic, crochet, crowd, curl, cut, daisy, dashboard, debate, deliver, denim jacket, diamond, dirt field, doll, dress, dressing room, drive, dye, earring, eat, engagement ring, equestrian, exhaust hood, eyebrow, eyeliner, fan, fashion show, father, fawn, figure skater, flag, flash, flight attendant, flip, floor, flower, folder, freckle, fur, fur coat, game controller, gathering, gift, gift box, girl, graduate, grass, greenery, guitar, headboard, headdress, hearing, hedge, hip, home appliance, hood, horse, hospital bed, hug, hydrant, interview, ivy, jacuzzi, jockey, kangaroo, khaki, kitchen, kitchen counter, knit, lamp, laptop, lash, ledge, leotard, lick, lighthouse, lightning, lipstick, lollipop, lush, makeup artist, microscope, mirror, model, mother, motorcycle, mouth, necklace, neon light, newborn, news, nose, office building, office window, officer, oven, overall, package, palm tree, pastry, pearl, pen, pencil, pet, phone, photo, picture frame, pigtail, pillar, pillow, pilot, pink, podium, poinsettia, pole, ponytail, pool, pop artist, pose, premiere, prom, pug, purple, python, raceway, ramp, razor, relax, ribbon, ring, sailor, salon, savanna, scarf, scooter, screen, seashell, seat belt, selfie, shampoo, shawl, shopping bag, short, shower curtain, slice, smartphone, smell, smile, sparkle, sparrow, speech bubble, sports ball, sports coat, spray, stable, stack, steering wheel, stethoscope, stick, strip, stripe, subway, sunflower, sunshade, suspenders, swim, swimming pool, syringe, tabby, take, tape, tapestry, tiara, toothpaste, toothpick, train window, treat, trench coat, tulip, umbrella, vampire, veil, video camera, violet, violinist, volleyball, volleyball player, wall, water, wedding, wedding dress, wheat field, wheel, wig, wind, wine, wine bottle, woman, wound, wrap, wristband, writing

Table 18. Waterbirds irrelevant tags.

class	tags
landbird	accordion, airplane window, airship, alcohol, algae, amphitheater, amusement park, anemone, ant, apple, apple tree, aquarium, area, arm, armchair, armor, army, arrow, asparagus, atrium, attach, atv, aurora, author, autumn, autumn forest, autumn leave, autumn park, ax, baby, baby carriage, back, backdrop, backpack, backyard, bag, balance, balcony, ball, balustrade, bamboo, bamboo forest, banana, banana tree, bandeau, bangs, banyan tree, barge, bark, barrel, barrier, baseball bat, baseball hat, basin, bass, bat, bath, beach ball, beach house, beach towel, beam, bear, bear cub, beautiful, beer, beer bottle, belly, bench, bengal tiger, beret, berry, beverage, bicycle, bicycle helmet, biker, bikini, bikini top, bin, birch, birch tree, bird bath, bird cage, bird feeder, blade, blanket, blood, bloom, blossom, blowfish, blue, blue jay, board, boardwalk, boat house, boat ride, bobfloat, bonfire, book, boot, bottle, boulder, bouquet, boy, branch, break, bride, bridesmaid, bronze statue, broom, brown, brunette, brush, bubble, bud, buddha, bug, bundle, buoy, bush, business suit, butterfly, cabana, cabin, cactus, cage, camera, camouflage, camp, campfire, campsite, can, canal, cane, canopy, cape, cardigan, carnival, carp, carpet, carry, cart, carve, catamaran, catch, cave, ceiling, cement, champagne, chase, cherry, cherry blossom, cherry tree, child, christmas hat, christmas light, church, cigar, cigarette, cinema, city park, claw, clear, cloak, cloth, clothesline, cloud, clown fish, cocktail dress, coconut, coconut tree, coffee, coffee cup, collage, color, computer, computer monitor, computer screen, cone, construction site, continent, copy, coral, cosmetic, cotton, cowboy hat, coyote, crack, creek, cross, crowd, crowded, cruise, cub, cup, curb, curtain, curve, cycle, cypress tree, daffodil, daisy, dandelion, dark, dashboard, daughter, debris, decorate, deer, deity, denim jacket, desert, destruction, dew, diaper, dinning table, dirt bike, dirt field, dirt road, dirt track, diving board, doberman, doll, doodle, doorway, dragonfly, drain, drawing, drift, drink, drinking water, drive, dry, duckling, dune, dust, elephant, enclosure, equipment, eucalyptus tree, evening sky, evergreen, face, fairy, fall, family, family photo, fawn, feed, fence, fern, ferris wheel, fiction, field, fighter jet, figurine, finish line, fire, firework, firework display, fish pond, fisherman, fishing net, fjord, flag pole, flame, fleet, flood, floor, flower, flower bed, foam, fog, foggy, foil, folding chair, foot, footprint, footstall, forehead, forest, forest floor, formation, fountain, frog, frost, frosty, fruit tree, fungi, garbage, garden, gas, gazebo, giraffe, glacier, glass building, glass house, glass table, glasses, goldfish, goose, grain, grampus, grass, grasshopper, grassland, grassy, grave, gravel, gravestone, graveyard, gray, graze, green, greenery, greyhound, groom, ground squirrel, grove, guard, guitar, gun, hair, hallway, hammer, hammock, hand, handgun, hang, hay, hedge, helicopter, helmet, herd, hibiscus flower, hide, hike, hiker, hill, hillside, hippo, horse, horseback, hose, house, house exterior, house finch, husky, hut, ice cave, icicle, illuminate, image, individual, insect, instrument, island, ivy, jacket, jaguar, jeans, jeep, jet, jog, jungle, kilt, kiss, kitchen window, kite, koi, ladder, lagoon, lamb, lamp, lamp post, land, lantern, lap, laugh, lavender, lay, lead, lead to, leaf, leash, ledge, lemur, leopard, leotard, lichen, lick, life belt, lifeguard, lift, light, lilac, limb, line, liquid, load, lock, log, log cabin, lotus, lush, magnifying glass, mall, maple, maple leaf, marathon, mark, martini glass, measuring tape, mermaid, miniature, miniskirt, missile, moat, monkey, monocycle, moon, moonlight, morning fog, moss, moth, motorbike, motorcycle, motorcyclist, mound, mountain bike, mountain biker, mountain biking, mountain gorilla, mountain lake, mountain landscape, mountain path, mountain range, mountain stream, mud, mug, mushroom, music, navy, necklace, nectar, net, newlywed, oak tree, office building, officer, oil, open, opera house, orange, orange tree, otter, out, overall, oyster, pagoda, paint brush, palace, palm tree, panda, paper bag, paper lantern, parachute, paradise, parasail, park, park bench, parking lot, passenger train, path, pavement, pavilion, paw, peacock, peak, peanut, pearl, peel, pencil, perch, pergola, pet, petal, pheasant, photographer, pick up, picnic table, pig, pigtail, pillar, pillow, pilot boat, pine cone, pine forest, pink, pipe, pirate ship, pitcher, pitcher plant, plank, plant, plaque, plastic, play, playground, plectrum, plume, pod, pole, pollen, pollution, pond, ponytail, porch, post, postcard, pot, power line, power station, purple, push, python, quail, race, raft, railroad, rain, rainbow, rainbow trout, raincoat, rapid, read, red, red panda, redwood, reed, reel, reflect, reindeer, reptile, resort, restaurant, rice field, rider, rifle, rink, ripple, rise building, river, river boat, robe, rock face, roof, root, round table, rubble, ruler, run, runner, rust, safety helmet, sand castle, sandal, savanna, sax, scooter, scorpion, screen, screen door, sea cave, sea turtle, seashell, seawall, seaweed, sedan, selfie, shawl, shed, sheep, shell, shelter, shine, shipwreck, shopping cart, short, shoulder, shovel, shrine, sign, silverware, sing, sip, sit, skate, skate park, skateboarder, skeleton, skier, skyline, skyscraper, sleep, sleepwear, sleigh, slide, smell, smile, smoke, snail, snake, snorkel, snow, snowboarder, snowman, snowstorm, snowy, spark, sparkle, sparkler, spear, spider web, spike, spire, splash, sprinkler, squirrel monkey, stab, stack, stadium, stand, statue, steam, stem, stingray, stomach, stone building, stool, storm cloud, strap, straw, stream, street light, street sign, string, stroll, structure, stuff, stump, stunt, succulent, suit, sunbathe, sunflower, sunflower field, sunglasses, sunshade, sunshine, surface, surround, suspension bridge, suv, swan boat, sweater, sweatshirt, swim cap, swimming pool, swing, swinge, sword, table, table top, tablecloth, tail, take, tangerine, tank, tape, tattoo, tea, teal, telegraph pole, temperature, temple, tennis racket, tent, terrace, terrain, tie, tiger, tile roof, tire, toe, tool, torch, tortoise, towel, tower bridge, town, track, traffic cone, trail, trailer, trailer truck, train, train car, train track, trainer, travel, tree, tree branch, tree house, tree root, tree trunk, trench, trench coat, tricycle, tripod, trolley, tropic, trout, truck, tub, tube, tugboat, tundra, turquoise, turtle, twig, twilight, umbrella, underclothes, uniform, urban, vegetation, vehicle, veil, volcano, wagon, walk, wall, warning sign, waste, water drop, water feature, water lily, water pipe, water ski, waterfall, waterway, web, wedding, wedding couple, wedding dress, wedding party, weed, wet, wheat field, wheelchair, white house, wild, wildflower, willow, wind chime, wind farm, wind turbine, windmill, window, window sill, wine, wine bottle, wine glass, winter, winter scene, wire, wisteria, wolf, wood, wood floor, wood wall, woodland, world, worm, wrap, writing, yard, yellow, zebra, zoo
waterbird	Border collie, aircraft carrier, album, album cover, algae, amusement park, antler, appear, apple, apple tree, apron, aquarium, army, arrow, aurora, autumn park, ball, ballerina, ballet, ballet dancer, ballet skirt, balustrade, banana tree, barbie, bark, barrier, baseball hat, basket, battleship, beach, beach chair, beach hut, beach towel, beam, beautiful, beaver, belly, bench, berry, bicycle, bikini, bikini top, birch, bird bath, bird feeder, blossom, board, boardwalk, boat, boat house, boat ride, bottle, boy, bridge, broom, brown, brunette, bubble, building, buoy, bus, bus window, bush, cabana, cactus, calm, camera, camp, camper, campsite, can, canoe, car, car mirror, car window, cargo ship, carp, carrot, carry, cave, chain, chair, chase, cheetah, chest, child, chimney, chopstick, cinema, city, city park, city skyline, city view, city wall, cliff, climb, cloth, cloud, cloudy, coast, coat, coconut tree, collage, collect, concept car, cone, corn field, couple, course, crash, crest, crowd, crowded, cruise, cruise ship, curb, cycle, daffodil, dam, dance, dancer, dark, dashboard, daybed, deck, deer, den, denim jacket, destruction, dirt field, dirt road, dirt track, disco ball, diving board, dock, doll, donkey, doorway, driftwood, drive, dry, eel, eucalyptus tree, evergreen, eye, fall, fawn, fence, fern, ferry, field, fighter jet, fin, fishing, fishing pole, fjord, flag, fleet, flip, float, flood, flower bed, fly, fog, foggy, foil, folding chair, food, football field, football game, footprint, forest floor, formation, frog, frosty, frozen, fruit, fur, garden, gazebo, glass table, goal, goggles, goldfish, golf course, goose, grass, grassland, grassy, gravel, gray, graze, guard, gun, habitat, hair, hammock, harbor, hat, hay, hedge, hiker, hillside, hook, horizon, horse, horseback, hose, hotel, house, house exterior, humpback whale, hurdle, hut, hydrangea, ice, ice floe, iceberg, icicle, image, island, jacket, jet, jog, jump, jungle, kayak, kite, knit, koi, ladder, lagoon, lake, lamp post, land, landing, lap, laugh, lay, leaf, ledge, lens, leotard, license plate, lift, light, lighthouse, lightning, log, lotus, machine gun, mallard, mammal, mast, mat, mermaid, mollymawk, moon, moonlight, moose, motorboat, motorcycle, mountain, mountain lake, mud, nectar, needle, nest, night, night sky, night view, oar, office building, open, otter, out, paddle, paling, palm tree, parachute, parasail, park, patch, pavement, peak, pearl, pencil, pepper, perform, person, pet, pheasant, photo, photographer, picnic table, picture, pine cone, pirate ship, pitcher, pitcher plant, plain, plane, plank, plastic, play, point, pole, pollution, pond, pool, poster, power line, power station, prom, puddle, race, raceway, raft, rail, railroad, rainbow, rainbow trout, ramp, ray, rearview mirror, recreational vehicle, redwood, reed, reflect, reflection, relax, resort, ride, rifle, ripple, river bank, riverbed, road, road sign, robe, rock formation, rocky, rodent, rope, rowboat, ruins, run, sail, sailboat, sand, sandal, sari, savanna, schooner, scooter, sea, sea cave, sea lion, seal, selfie, shark, shine, shipwreck, shore, shoreline, silo, sky, skyscraper, sleepwear, smoke, snow, snow leopard, snowy, sphere, splash, spoon, sports car, spray, squat, stand, starling, statue, stingray, stone, stone building, stone house, stool, storm, stormy, straw hat, stream, stretch, strike, string, stump, stunt, sun, sun hat, sunbathe, sunglasses, sunrise, sunset, sunshine, surf, surface, surfboard, surfer, surround, swamp, swan, sweatshirt, swim, swimmer, swimming pool, swing, sword, table, take, takeoff, tank, tape, tarp, taxi, telegraph pole, terrain, thunderstorm, tiara, tortoise, towel, tower, town, track, traffic sign, trailer, train car, train track, trench coat, trim, tripod, tropic, trout, turkey, turquoise, turtle, twilight, urban, vehicle, veil, vessel, video camera, view mirror, vine, warning sign, warship, water, water lily, water ski, waterfall, waterway, wave, weapon, wedding dress, weed, wet, wetland, wetsuit, whale, whale shark, wheat field, white, wig, windshield, winter, winter scene, witch, woodland, zoo

Table 19. UrbanCars irrelevant tags.

class	tags
urban-car	advertisement, alley, apartment, archway, atm, attach, back, backyard, balcony, balustrade, bear, bin, binocular, bird, black, brick building, brush, building, bus stop, bush, cage, canopy, carpet, catch, ceiling, ceiling fan, charge, chase, chimney, city, city skyline, city street, city view, cliff, cloth, collage, corn field, corridor, country lane, countryside, courthouse, crane, crash, creek, crop, crosswalk, curb, cut, dark, destruction, display, dog house, doodle, door, doorway, dune, dust, enclosure, evergreen, exit, explosion, fence, fill, fire truck, fireplace, flip, flood, floor, fuel, garage, garage door, gas, gas station, gravel, green, greenery, gun, hand, hang, hay, head, headlight, hedge, home, hood, horseback, house, house exterior, hurdle, hut, hydrant, ice skating, illuminate, intersection, jockey, jump, lake, lamp, lamp post, lawn, ledge, lift, lighthouse, line, living room, mat, meter, miniature, mountain, narrow, neon light, night, night view, number, office building, out, outdoor, outhouse, overpass, paling, palm tree, park, parking garage, parking lot, parking meter, parking sign, pavement, peak, pen, pergola, phone box, pillar, pine, pine forest, pink, plant, plug, pole, post, pot, power line, pump, rail, railroad, rain, ramp, ravine, red, reindeer, rink, rise building, road sign, row, sale, sculpture, shed, shelter, sign, signal, silo, skate, skyscraper, smoke, snow, snowboarder, snowy, speed limit sign, stable, stair, stall, stare, stick, stone building, stool, stop sign, store, storefront, street corner, street scene, street sign, stunt, tarp, telescope, terrace, toy, track, traffic light, traffic sign, train, train car, train track, trick, trim, tunnel, umbrella, unicorn, urban, vegetation, vineyard, wall, warehouse, warning sign, water, wheat field, white, white house, yak, yard, yellow, zebra crossing
country-car	advertisement, animal, apartment, arrow, atv, autumn forest, autumn tree, back, balustrade, bamboo forest, barrier, bat, bear, bed, bend, bicycle, black, boardwalk, boulder, bride, bridge, brown, brown bear, buffalo, build, bull, bus stop, bush, cage, calf, cart, cattle, chase, chimney, city street, cliff, climb, cloud, cloudy, coach, construction site, corridor, country lane, couple, cow, cowboy, crane, crop, cross, curve, daffodil, dam, deer, desert, desert road, dirt bike, dirt field, dirt road, dirt track, dog, donkey, door, dust, elephant, enclosure, evergreen, farmland, fence, field, fire escape, fire hose, fire truck, flag, flower, forest, forest path, forest road, gas station, gasmask, goat, goggles, grass, grassy, grave, gravestone, graveyard, gray, graze, green, gun, hallway, handstand, head, hedge, highway, hill, hillside, hook, horse, horse cart, horseback, hut, ice cream cone, jump, lamb, land, lay, leash, lift, lighthouse, line, log, lush, milk, minibus, moose, mound, mountain, mountain path, mud, mural, night sky, out, parachute, parking, path, peak, pig, pine, pine forest, pink, plain, plectrum, plow, pony, pull, pump, railroad bridge, ram, redwood, reflection, relax, rhinoceros, rice field, ride, rise building, road, road sign, rock formation, rocky, rural, sand, savanna, scaffold, schooner, sculpture, sea, sheep, shelter, signal, silver, sit, sky, snow, snowy, speed limit, speed limit sign, squirrel, stable, stair, stairwell, stand, star, stare, stone, stool, storefront, stormy, street corner, street light, stretch, stuff, sun, sunset, swing, telegraph pole, terrain, toy, track, traffic cone, trailer, travel, tree, trench, trick, trumpet, umbrella, unicorn, view mirror, vineyard, wagon, walk, warehouse, warning sign, water tank, water tower, white, wood, yak

Table 20. ImageNet9 irrelevant tags.

class	tags
Dog	CD, French bulldog, antler, appliance, area, arm, armchair, back, backdrop, backyard, bag, balance, barn, barrel, barricade, barrier, baseball hat, basin, basket, bath, bathroom, bathroom sink, bead, bed, bedcover, belt, bench, beret, bib, black, blanket, blood, blue, boardwalk, boat, bookcase, bookshelf, boulder, bow tie, bowl, boxer, boy, break, broom, brown, brush, bubble, building, bureau, bush, cabinet, cap, car seat, car window, carpet, carrot, carry, cat, cat food, cement, chair, child, christmas, christmas hat, cloth, cocktail dress, comfort, computer, computer chair, computer desk, computer monitor, concrete, cone, contest, corridor, counter top, course, court, crack, cube, curb, dachshund, daisy, dandelion, deck, dirt field, dirt road, dirt track, dish washer, dock, doll, door, doorway, dot, drawer, dress, dresser, drink, duffel, eat, enclosure, eye, face, fairy, farm, feed, fence, fern, finish line, fireplace, flower, flower bed, folding chair, football, footprint, forest, fridge, frisbee, frost, frosty, garden, gift, girl, glass door, goggles, gravel, green, greyhound, guinea pig, hair, hallway, hand, handkerchief, hardwood, hardwood floor, hassock, hay, head, headscarf, hide, hillside, home appliance, hose, house exterior, hug, hurdle, jeans, judge, kiss, kitchen, kitchen cabinet, kitchen counter, kitchen floor, kitchen island, kitchen sink, lamb, lap, laundry basket, lawn, leather jacket, ledge, living room, log, lollipop, lush, magnet, man, measuring tape, milk, miniature, moose, motorbike, motorboat, motorcycle, motorcyclist, mound, neck, necklace, obstacle course, office, office chair, office supply, open, out, paling, paper towel, park, pasture, patch, path, pavement, pen, pencil, person, photo frame, picnic table, picture frame, plant, plate, pointer, pole, polka dot, poodle, porch, pot, quilt, racket, rail, ramp, red, reindeer, river, road, rocking chair, rocky, roll, room, round table, rural, scarf, screen door, seat, seat belt, shadow, shake, shirt, siding, sign, sink, ski, ski pole, sky, sleeping bag, sleepwear, slide, smile, snow, snowy, soap, sports ball, spray, stand, stare, stethoscope, stick, stone, stool, strap, stuff, stump, sun, sunglasses, swab, sweater, sweatshirt, tabby, table, take, tan, teddy, tennis, tennis court, tie, tile, tool, towel, trainer, trumpet, tub, tube, tulip, tusk, umbrella, vegetation, wagon, wash, watering can, wear, wet, white, white house, window, window sill, wine glass, winter, woman, wood, wood floor, wood wall, wool, wrap, wrapping paper, wrestle, yellow
Fish	algae, appear, aquarium, attach, bag, bait, ball, banana, baseball hat, basin, bass, bat, bath, bathroom, bathroom accessory, bathroom sink, beach, beach chair, bean, beard, beautiful, beetle, billiard table, bin, bite, black, blade, blood, blue, boat, bowl, boy, brush, bubble, bug, buoy, cactus, cake, calm, camouflage, camp, campfire, campsite, canoe, cat, catch, caterpillar, cave, ceiling, chair, child, chocolate cake, clear, cliff, cloth, coast, color, comb, container, coral, coral reef, couple, coverall, cowboy hat, crack, creek, dark, display, dive, diver, dock, doll, dolphin, dress, dry, dye, enclosure, entertainment center, eye, fang, fedora, fin, fish market, fisherman, fishing net, fishing pole, flat, float, folding chair, foot, footprint, frosting, frying pan, gasmask, gecko, girl, glass bowl, glass table, grampus, gray, green, hairbrush, hand, hat, head, hole, humpback whale, ice, image, jacket, joker, jumpsuit, kayak, koi, lagoon, lake, land, laugh, ledge, lid, life jacket, lush, machete, man, market, mask, mine, mound, mouse, mud, muscle, net, night, overall, package, pad, paddle, pancake, peak, pearl, peel, penguin, pepper, person, pet, pharmacy, phone, photo, pink, plant, plastic, plate, platter, pod, pole, polka dot, polo shirt, pond, pool, pose, profile, puddle, purple, raincoat, ram, reel, river, rock formation, rocky, sack, safety vest, sale, sandal, sea, sea cave, sea lion, sea urchin, seabed, seal, seashell, shine, shirt, shirtless, shore, shoreline, showcase, silver, sit, skate, smile, snorkel, snow, spike, sponge, squat, squid, stab, stand, stem, stingray, stone, stool, strainer, strap, stream, stuff, sun, sun hat, sunglasses, surface, suspenders, sweatshirt, swim, swimming pool, swimwear, swordfish, table, tail, tank, tape, tarp, teddy, tent, toe, toilet bowl, toilet seat, tool, torch, tortoise, toy, tree, tripod, tropic, trumpet, tube, turquoise, turtle, tusk, twig, underwater, urinal, vegetation, vessel, vest, water, waterway, wear, weed, wetsuit, whale, whale shark, white, woman, wood, yellow
Bird	area, attach, baby, balustrade, bark, beach, bean, bed, bend, berry, bill, birch tree, bird bath, bird cage, bird feeder, bird house, bird nest, birdbath, blanket, bloom, blossom, blue, boulder, branch, brown, brush, bud, building, bunk bed, bureau, bush, cabinet, calm, car mirror, car window, catch, ceiling, chase, cherry blossom, cherry tree, circle, clear, climb, close-up, cloud, coast, comb, cone, counter top, couple, creek, crest, cross, debris, dirt field, dock, driftwood, drink, dry, enclosure, evergreen, eye, face, feed, fence, field, fir tree, fish, flap, flight, float, flood, flower, flower bed, fly, food, foot, forehead, forest, garbage, grain, grassland, grassy, gravel, gray, graze, greenery, gull, hand, hay, head, hide, hillside, house finch, kitchen counter, kite, ladder, lake, land, landing, lap, laugh, lavender, ledge, leg, lizard, metal, mollymawk, mound, mouth, mud, mulch, neck, nectar, nest, night, nose, nut, open, osprey, ostrich, out, paling, paper, patch, peak, peanut, pen, penguin, perch, pillar, pillow, pine, pine cone, pink, plain, plank, plant, plow, portrait, post, power line, puddle, purple, raft, rapid, rearview mirror, red, reflection, relax, rice field, ripple, river, rock formation, rocky, roof, room, rope, sand, savanna, sea, seabird, seal, seaweed, seed, shirt, shore, shoreline, sip, sit, sky, smile, snowy, spread, spruce, stem, stick, stilt, stone, stretch, string, sunflower seed, swim, table, tail, teal, telegraph pole, thistle, tile, tile roof, toy, tree, tree branch, tropic, turkey, twig, vegetation, view mirror, walk, water, water lily, wave, weed, wet, wetland, wildflower, window sill, windshield, wing, wire, wood, yard, yellow, zoo
Vehicle	advertisement, air field, alcohol, alley, ambulance, amusement ride, animal, antique, approach, arena, armor, auto show, baby, back, balance, barn, barrel, barricade, barrier, basin, beach, beach chair, beautiful, bench, bend, bicycle helmet, biker, bin, bird cage, black, blow, blue, boat, boot, bottle, box, boy, brick building, bridge, broom, brown, brunette, buffalo, building, bull, bullet, bumper, cabin, cabin car, cage, camper, campsite, cane, canopy, car show, cardboard box, carpet, cat, catch, cattle, ceiling, cement, chair, check, child, city, city square, city street, classic, cliff, cloud, cloudy, coast, cock, commuter, cone, construction site, construction worker, container, cooler, countryside, coupe, couple, course, cow, cowboy boot, cowboy hat, crane, crate, crop, cross, crowd, crowded, curb, curve, cycle, cylinder, dark, dashboard, decker bus, decorate, desert, desert road, destruction, dirt bike, dirt field, display, dock, dog house, donkey, doodle, door, doormat, doorway, dozer, dress, drift, driveway, dust, elephant, emergency, emergency service, enclosure, envelope, equipment, evergreen, excavator, face, fence, field, figurine, fill, fire department, fire hose, fire station, fire truck, fireman, flag, flame, flip, flood, floor mat, flower, fly, food truck, forest, garage, garage door, garbage, garbage truck, garden, garden hose, generator, girl, go, goat, goggles, gold, golf cart, grass, grassland, grassy, gravel, gray, green, handcart, hangar, hat, hay, headlight, heart, hedge, helmet, hide, highway, hill, hillside, hip, hood, hose, house, house exterior, hut, intersection, jacket, job, jockey, jump, jumpsuit, karting, kayak, ladder, lake, lamp, lamp post, land, lap, lawn, lay, lean, leash, lego, lifeguard, lift, lighthouse, livestock, load, loading dock, lock, lorry, machine, magazine, mall, mat, miniature, miniskirt, missile, model, model car, monocycle, monster truck, motorcycle racer, motorcyclist, mound, mountain, mountain path, mower, mud, mulch, mule, muscle car, museum, narrow, night view, number, obstacle course, office building, open, operate, overall, overpass, palette, palm tree, panel, parade, paramedic, park bench, parking, parking lot, pass, passenger, passenger train, patch, pavement, peak, pen, pet, photo, pick up, picnic table, pillow, pine, pink, pipe, plain, plant, plaque, platform, plaza, plectrum, plow, plume, pole, police, police station, pose, pot, power line, puff, purple, race, race track, rail, railcar, railroad, railroad bridge, railway station, rain, rake, ramp, red, repair, rickshaw, rifle, river, road, rock face, rock formation, rocket, room, rust, saddle, safari, safety vest, sand, savanna, scaffold, scale model, schooner, sea, seawall, security, shed, shelf, shipping container, shirt, shoreline, short, shovel, showcase, sidecar, sign, silver, ski equipment, ski slope, skier, sky, sleep, sleigh, slope, smile, smoke, snail, snow, snowboard, snowboarder, snowmobile, snowplow, snowstorm, snowy, sock, solar battery, spectator, speedboat, spin, spray, station, steam, steam engine, steam train, stilt, stocking, stone building, stormy, strap, straw, straw hat, street artist, street corner, street scene, street sign, stretch, string, stunt, sun hat, sunset, swimwear, table, tablecloth, tape, tarmac, tarp, teach, teal, telegraph pole, terminal, tile wall, tire, tool, toolbox, tour bus, toy, toy car, track, tractor, traffic cone, traffic light, trail, train track, travel, tree, tree trunk, trench, trick, trolley, troop, trumpet, tub, turn, turquoise, umbrella, underclothes, urban, vegetation, vespa, vessel, vest, wagon wheel, walk, wall, warehouse, waste, water, water tank, watering can, weapon, wear, weed, wet, wheel, wheelie, wildflower, wind farm, wind turbine, windshield, wine bottle, winter, wiper, wood, wood wall, worker, wreath, writing, yard
Reptile	algae, amusement park, aquarium, arm, armadillo, baby elephant, back, bag, balloon, banana, banana tree, bank, bark, barrel, baseball glove, baseball hat, basin, bath, bathroom sink, beach, beak, bin, bird, black, blanket, blowfish, blue, bottle, boulder, box, bracelet, branch, break, brick, bronze statue, brown, bubble, bug, building, bull, bush, cage, car, car window, cardboard box, carnival, carp, cat, ceiling, cement, chair, chase, cigarette, claw, clear, climb, cloth, clown fish, coast, coconut tree, coin, computer, computer desk, concrete, container, coral, coral reef, crack, creek, crochet, cross, curl, dart, dashboard, desert, dinosaur, dip, dirt field, dirt road, dirt track, display, diver, draw, driftwood, dry, duckling, dune, eagle, enclosure, eye, fang, fern, field, figurine, fish, float, floor, flower, flower bed, food, footprint, forest floor, fossil, fruit, garden, glass table, goggles, grass, grasshopper, grassy, gravel, green, greenery, habitat, hamster, hang, hardwood floor, hay, head, hedge, hide, hill country, hippo, hood, hunt, hut, jaw, key, keyboard, knot, land, lap, lay, leaf, leash, ledge, lego, lid, limb, log, lush, mammal, man, marine, mat, measuring tape, meat, melon, miniature, moose, moss, moth, mouse, mud, mulch, museum, neck, nest, net, night, office supply, open, orange tree, package, pad, palm tree, paper towel, parrot, patch, path, pavement, paw, peak, pebble, pen, penguin, penny, perch, person, petal, photo, pillar, pillow, pink, pipe, plank, plant, plastic, play, pole, polka dot, pond, pool, poodle, puddle, purple, rail, ram, rat, red, reed, reef, reflection, relax, rhinoceros, ride, ripple, river, river bank, road, rock face, rock formation, rocky, rodent, sand, sandal, school, screen door, sculpture, sea, sea lion, seal, seashell, seaweed, shadow, shape, shell, shoe, shore, shoreline, showcase, shrub, sink, sip, sit, skeleton, skull, sky, slider, slipper, slug, snail, snow, spiral, spray, stand, stare, statue, stone, stool, strap, straw, stuff, stump, sun, sun hat, sunbathe, surf, surface, swamp, swim, swimmer, swimming pool, table, tank, terrarium, toilet bowl, toilet paper, toilet seat, toy, tray, tree, tree branch, tree trunk, trumpet, tub, tube, twig, underwater, unicorn, up, vegetable, vegetation, walk, wall, wash, watch, water, wave, weed, wetsuit, whale, white, window sill, windshield, wood, wood floor, world, wrap, wristband, yellow, zoo
Carnivore	CD, appear, apple, apple tree, aquarium, area, arm, backdrop, bag, balance, ball, bamboo, bamboo forest, bank, basket, bath, bathroom accessory, bathroom sink, beach, beak, bear cub, beaver, belly, bin, birch tree, bird cage, bite, blanket, blood, boat, bottle, boulder, break, brush, bureau, bush, cabinet, cage, can, car, car window, catamount, catch, cave, chair, chase, chopstick, cigarette, claw, close-up, cloth, container, counter top, cowboy hat, crane, crate, creek, cub, cube, curl, daisy, dandelion, dark, deer, den, dirt field, dirt road, dirt track, dog breed, dog house, doorway, dot, dresser, drink, dry, eat, enclosure, evergreen, eye, fall, fang, faucet, fence, field, fir tree, fish, flower, flower bed, foot, footstall, forest, frosty, fruit, fur, grass, grassland, grassy, graze, green, greenery, greet, ground squirrel, guard, habitat, hamster, hand, hay, hide, hill, hillside, hole, ice floe, iceberg, illuminate, image, jaw, jump, jungle, lake, lamb, land, lap, laugh, lay, ledge, lick, log, lush, mammal, man, mane, meat, mound, mountain stream, mouth, mud, mulch, nest, night, night view, open, paper bag, path, pavement, peak, pen, pencil, perch, photo, pine, pink, plain, plant, plastic, play, pole, pond, pool, portrait, post, postcard, profile, raft, rail, ram, red, red panda, reed, relax, river, river bank, riverbed, road, rock face, rock formation, rocky, roof, run, rural, savanna, screen door, sea, sea lion, seal, shadow, sheep, shelter, shirt, sink, sky, sleep, smile, snow, snowball, snowy, spruce, squat, squirrel, stand, stem, stick, stone, straw, stream, street dog, stretch, stripe, stuff, stump, sun, swamp, swim, tabby, tank, terrain, tiger, tire, toe, tree, tree trunk, trout, trumpet, tub, tube, tundra, twig, vegetation, walk, wall, waterway, weed, wild, wildflower, window sill, winter, woman, wood, wrestle, yard, yellow, zoo
Insect	acorn, alcohol, apple, apple tree, asphalt road, attach, autumn leave, ball, banana leaf, banana tree, bark, bat, bathroom, bathroom sink, beautiful, berry, bird, bird nest, bite, black, blackberry, bloom, blossom, blue, boulder, break, brick, broom, brown, brush, bumblebee, bush, butterfly house, cactus, candy cane, cane, car, cardboard, cardboard box, carpet, cat, ceiling, cement, chestnut, climb, close-up, cloth, cloudy, color, concrete, container, couple, crack, cricket, curb, daisy, dandelion, dirt field, dot, dry, evergreen, eye, feather, fence, fern, field, figurine, flap, floor, foot, forest floor, frog, fruit, fruit tree, garden, gasmask, glass bead, glass jar, glass vase, goggles, gold, grain, grass, gravel, gray, green, greenery, hand, hang, head, hide, hornet, hummingbird, image, ivy, jar, jump, land, larva, lavender, leaf, ledge, lemon, lid, lilac, limb, lush, maple leaf, marble, mat, measuring tape, microscope, mud, mulch, napkin, needle, nest, night, nose, nut, orange, orange tree, pad, paint brush, paper towel, parrot, patch, pavement, peel, peony, perch, person, pest, pet, petal, photo, pillar, pillow, pine, pink, plant, plastic, pole, polka dot, pond, poppy, post, pot, puddle, rail, red, reed, roach, road, rock face, rocky, roll, rope, rose, ruler, sand, scale, screen door, sea, seed, shadow, sign, sit, skin, sky, slug, spider web, spruce, stab, stand, stare, stem, stick, stone, stool, string, stripe, stump, swab, swallowtail butterfly, swirl, tabby, tank, thistle, tile wall, tissue, toilet paper, toilet seat, tool, tree, tree branch, tree frog, tree trunk, vegetation, violet, walk, wall, water, water drop, wave, web, white, wildflower, window, wire, wood wall, writing, yellow
Instrument	CD, Eiffel tower, alcohol, alley, altar, amplifier, animal, antique, arch, armchair, army, art, artifact, assembly line, autumn leave, baby, backdrop, bag, balcony, ball, balustrade, band, bangs, banjo, bar stool, barrel, baseball bat, baseball glove, baseball hat, basement, bassist, bat, bath, bathroom, bathroom accessory, bathroom sink, battery, beach, bead, beam, beard, bedroom, beer, beer can, belt, beret, beverage, billard, billiard table, bird, birthday, birthday cake, bite, blade, blanket, blender, blowfish, boardwalk, boat, boiler, book, bookshelf, boot, bottle, bottle screw, bouquet, bow, bow tie, bowling ball, braid, brass, brick, brick building, brooch, broom, brown, brunette, brush, bubble, bullet, bundle, bureau, bust, cabinet, cage, cake, camp, can, cane, canopy, cape, carnival, carpet, carrot, carry, carve, cat, cathedral, ceiling, ceiling fan, chain, chandelier, chapel, check, chestnut, chicken, chocolate cake, choir, chopstick, christmas hat, church bench, cigar, cigarette, clay, cloak, close-up, closet, cloth, cloudy, club, clutch, clutch bag, coast, cock, cocktail dress, comb, computer, concert, concert hall, conductor, connect, container, copper, corner, cosmetic, cosplay, costume, cotton candy, couch, counter top, cowboy hat, crowd, crowded, crumb, cue, cup, curb, curtain, cylinder, dam, dance, dark, dart, daylight, decorate, design, dirt field, disco ball, display, doll, door, door handle, draw, drawer, dress, dress hat, dress shirt, dresser, drink, dumbbell, eagle, earphone, earring, elastic band, electronic, equipment, face, fair, fan, faucet, feather, fedora, festival, field, figurine, flag, flap, float, flower, folding chair, fondant, foot, football field, football game, footrest, footstall, fountain pen, frosting, fruit, frying pan, garment, gathering, geisha, glass bead, glass bowl, glass vase, glass window, glasses, goggles, gold, grass, grassy, gray, green, hair, hair hall, halloween, hand, handle, hang, hardwood, hardwood floor, harpsichord, hassock, hat, hay, head, headdress, headscarf, heart, hen, hill, hillside, hole, home appliance, hook, hose, hospital bed, icing, image, iron, ivory, jacket, jeans, joker, juice, keyboard, khaki, kilt, kit, kitchen counter, kitchen utensil, kitchenware, knot, lamp, lamp shade, lap, laptop, laptop keyboard, laugh, lead singer, lean, lecture hall, lick, lid, light, liquid, living room, load, log, loom, lush, machine, magnet, magnifying glass, make, mallet, maraca, march, marching band, match, measuring tape, mechanical fan, megaphone, milkshake, miniature, mirror, mixing bowl, mixture, model, molding, money, monk, mother, mouse, mouth, muscle, museum, music stool, music studio, musician, napkin, navy, neck, necklace, nose, nun, nut, officer, onion, open, outdoor, overall, overpass, owl, package, pad, paddle, palace, palette, pan, pant, paper towel, parade, park, parrot, pearl, pen, pencil, pendant, pendulum, perch, perform, phone, photo frame, picnic table, picture frame, piggy bank, pigtail, pillar, pin, pink, pipe, pirate, plaid, plank, plant, plaque, plastic, plate, platter, play, plaza, plug, plum, pocket watch, point, poker table, ponytail, pool, porch, pose, poster, pot, preacher, pulpit, purple, pyramid, quilt, racket, radiator, razor, razor blade, recording studio, reed, reel, reflection, relief, rifle, road, robe, rock band, rock concert, rocking chair, roller skate, rope, row, rust, sailor, sand, sauna, saw, scarf, scoop, screw, screwdriver, scroll, sculpture, sea, seashell, selfie, shape, shawl, sheet, sheet music, shelf, shell, shelve, shield, shirtless, shore, shoreline, short, shoulder, showcase, shrine, side, signature, silver, sing, singer, sink, skate, skateboard, skateboarder, skeleton, skewer, ski pole, skier, sleep, sleepwear, smartphone, smile, smoke, snowboarder, soda, sombrero, sound, spatula, speaker, spear, sphere, spin, spoon, sport equipment, stack, stage, stage light, stair, stapler, stem, stick, stir, stone, stone building, strap, straw, straw hat, strawman, street artist, street corner, street vendor, strip, student, stump, subway, subway station, suit, sun hat, sunglasses, surface, surfboard, sweater, sweatshirt, swimming pool, swing, swinge, t-shirt, table, table lamp, tablecloth, tassel, tea pot, teal, telescope, tennis racket, tent, theater, tile wall, tin, tire, toddler, toilet paper, toilet seat, tool, toothbrush, toothpaste, toothpick, traditional, transporter, tray, tree, tribe, trick, tripod, trophy, tub, tube, turquoise, tusk, twig, uniform, utensil, velvet, vendor, vest, violinist, walk, wall, wall clock, wall lamp, warehouse, water, wig, wind chime, window, wine bottle, wine glass, wing, wire, witch, wok, woman, wood, wood floor, wood wall, wooden spoon, workbench, workshop, wristband, writing, yellow
Primate	appear, apple, attach, baby, baby elephant, back, balance, ball, balustrade, banana tree, bandage, barrel, basin, basket, bat, bath, bench, berry, bird cage, bite, black, blade, blanket, blue, boardwalk, bookshelf, bottle, boulder, branch, break, broccoli, brown, brown bear, building, canopy, car, car window, card, carrot, cat, catch, cement, chair, chase, clarinet, claw, cliff, close-up, cob, coconut, computer, container, couple, cub, curb, dinning table, dirt road, dirt track, display, dog, dog house, drink, dry, eat, enclosure, eye, face, fang, field, flower, flute, fruit, fur, grassland, greet, greeting card, hair, hammock, hand, hang, hat, hay, head, hedge, hook, hot, howler, huddle, hug, husky, hyaena, impala, jump, karate, koala, land, lap, laptop, laugh, lay, leash, ledge, leprechaun, lick, log, mammal, man, mane, martial, milk, motorbike, motorcycle, motorcyclist, mound, mountain, mouth, neck, neckband, night, nose, open, owl, palm tree, panda, park bench, parrot, patch, peak, peel, perch, person, pet, picnic table, pillar, plain, plank, plant, play, pole, pool, poppy, power line, profile, rail, ramp, red, red panda, relax, ride, rock face, rock formation, roll, rope, rope bridge, sale, sand, savanna, scooter, sea, shadow, shirtless, shoulder, showcase, siamese, sit, sky, sleep, sloth, smile, squat, stab, stare, steam, stem, stick, stone, stool, strap, straw, stretch, string, stuff, stump, sun hat, swing, swinge, table, tablecloth, tassel, telegraph pole, tie, tile wall, toy, treat, tree, tree branch, tree trunk, trumpet, tub, tusk, twig, wear, weed, white, window, window sill, wire, wood, yellow