

CS-410

# Aspect Based Sentiment Analysis

# Project Overview

The purpose of this repository is to create an aspect-based sentiment analysis (ABSA) model which involves a couple of steps. First, a review or comment is split up into topics using an unsupervised topic clustering algorithm. Then each sentence in the review is assigned to one of the topics and the sentiment for that sentence is evaluated. This allows us to assign an average sentiment for each topic.

# Training Sentiment Models

Please install Anaconda if it isn't already. Next, navigate to the local cloned repository and type the following in the linux shell:

- `conda env create -f environment.yml`

After the environment has been loaded, activate the environment with the following comand:

- `source activate tensorflow`

# Training Sentiment Models

To train the sentiment models, simply navigate to the src/training folder and run the following python files:

- setup.py
- train\_sent\_bow.py
- train\_sent\_cnn.py

The models can then be tested by running the "test\_sentiment.py" file

# Web Demo

<http://absa-api.us-east-2.elasticbeanstalk.com/>

## Instructions:

- Paste review in text field
- Select a number of topics
- Click "Process Review"

### Product Review Sentiment Analyzer

There are too many iPhones. Or, maybe there's just one new iPhone, in several step-up flavors. The iPhone XS and XS Max, along with the iPhone XR, are Apple's three new 2018 iPhones. But looking back on them now, in December, they have a lot more in common than you might think. Same new processors, same upgraded camera sensors and same image signal processors. Know that the XS is no longer the starting point for any iPhone X shopper: it's merely the slightly step-up model. The iPhone X was a singular design in 2017. This year, the trio of iPhone X models represent a spectrum from \$749 to nearly \$1,500, should you choose to pay for all the storage. When I first reviewed the XS, I considered it a modest upgrade over the X, and to wait for the XR (which was released more than a month later). That feeling holds true now that I've reviewed the XR. The iPhone XR is Apple's "affordable" X model, and the best iPhone to buy right now. Starting at \$749, it has Face ID and a depth-sensing front camera instead of a home button, just like the rest of the iPhone X gang. There's a notch at the top of the screen, too. It's faster and has better battery life than 2017's iPhone X, but has only a single rear camera (equipped with its own software-aided portrait mode that simulates depth of field bokeh effects), and a lower-res LCD screen instead of OLED. But for the vast majority of people, those are far from dealbreakers. In fact, it's the first choice you should make in buying a new iPhone. So, where does that leave the XS and XS Max? Luxury upgrades. Everything the XS offers still stands out, if you look hard enough.

#### Analysis Results

Product Aspect	Aspect Sentiment
Also Phone Charging	4.7
Iphone New Camera	4.8
Like Display Advantage	4.8
Apple Iphone Upgrade	4.9
Everyday Battery Easily	4.9
Faster Want Iphone	4.7

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Process Review

(Review copied from: <https://www.cnet.com/reviews/apple-iphone-xs-review>)

# Example Review

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An added 2x telephoto rear camera really does help frame shots better, and can make for more versatile portrait mode photos.

The OLED display is more vibrant, higher-resolution, and has much better black levels, but it won't always be something an average eye will spot.

The XS has a more durable construction: The rear glass doesn't crack as easily, and the stainless steel body won't ding as easily as the XR's aluminum.

The XS has bit faster cellular connectivity with gigabit LTE and improved 4x4 MIMO Wi-Fi antennas versus the XR, too.

The XS display has smaller bezels than the XR -- but the screen is smaller, too.

Does any of that matter to you? Pro users and anyone who's using their phone as a camera for their job should pick the XS, for its extra camera advantage and perfect display. Anyone else, though, should just get the XR instead.

Yes, it's that simple. Apple may have flooded the zone with lots of iPhones, but if you think about it as "how much phone to you need to pay for," the XR is the clear utility pick, and the XS is the fancy phone upgrade that you may or may not convince yourself to spring for.

This review was originally published Sept. 18. Update, Dec. 7: Adds final year-end battery comparisons and XR observations.

That HDR OLED display looks mighty nice. The iPhone X OLED screen already looked great, but the XS OLED does it a bit better. I noticed side-by-side improvements on the iPhone XS versus the X when watching Blade Runner 2049 and other HDR movies. The new display looks subtly brighter and richer at maximum brightness over last year's iPhone X, which already looked lovely. It's a great display, and better than the iPhone XR's lower-res, lower-contrast LCD. However, in normal everyday use, it's sometimes hard to tell the OLED from LCD to a casual eye. The XR's display is fine. Enthusiasts of perfect displays or pros needing top-notch detail might want the XS or XS Max.

The one camera advantage of the iPhone XS: dual rear camera

The telephoto lens on the XS and XS Max have 2x optical zoom and work in a telephoto Portrait Mode, just like the iPhone 7 Plus and 8 Plus cameras. That extra zoom can be helpful, and delivers great close-up shots for me on lots of occasions. It's also not entirely necessary, but if you're into taking the best photos regardless of price or use your phone as a pro camera tool, it's an upgrade worth considering.

The iPhone XR also takes portrait photos, but in a wide-angle mode using image processing that simulates the depth effect. It only works on people (the AI literally won't recognize anything else to activate the mode), and you need to get closer to your subjects when shooting. But it's good enough that it becomes one less reason to crave the XS.

If you compare camera specs for the 2017 iPhone X and the new iPhone XS, you'd think almost nothing's changed: Same dual cameras, same aperture settings, same megapixel ratings, same 2x optical zoom. But Apple's done plenty of work under the hood. The iPhone XR, XS and XS Max all have a totally new image sensor that really does noticeably improve the quality of photos. You could use any one of these phones and take similar step-up shots. The better sensor and the new image processor on the A12 Bionic chip combine to enable what Apple calls "Smart HDR." In practice, that means my photos look better in low light and extreme contrast situations, making for better pictures whether shot on a nighttime street, in a dark bar or in bright sunlight.

Bright lights in my living room show more detail now, and don't turn into blown-up bright spots like they used to. I see more detail around windows and street lights. I'm also finding less blur and noise in most shots. Sometimes, it almost seems like too much light. The color and brightness of some shots is surprising. I'm much happier with my photos now.

The larger sensor allows more light in, according to Apple, and I can tell. Focus is faster, too. But, keep in mind that the lower-cost iPhone XR can do all of this, too, in exactly the same way.

CNET did an in-depth photo comparison between the iPhone XS and iPhone X, and TL;DR: The photos are better, but not always dramatically so. For some shots, the difference matters a lot, with clear gains in detail and much less overexposure. But for others, the advantages can be subtle. And, in some cases, we find the iPhone XS' photo colors can end up looking a little less saturated, leading to some slightly less vibrant-looking pictures. But, no doubt about it, the iPhone XS takes improved photos, and it's noticeable.

But again, for the front-facing camera and rear wide-angle camera, you could buy the XR and get the same impact.

Note, too, that if you want the best overall camera in a smartphone right now, you need to migrate to Android and check out the Google Pixel 3 and 3 XL. With the addition of its Night Sight feature, it can shoot in dark environments where the iPhone (and nearly every other phone) offers little more than muddy blurs.

The big camera upgrade for 2017's iPhone X and iPhone 8 Plus (sold at Walmart) was portrait mode, which delivers DSLR-style head shots: focused face in the foreground, with an out-of-focus background. Known as "bokeh," this effect has been a must-have feature in every phone camera since.

For the 2018 models, Apple now also uses software to let you adjust background focus after you've shot a photo. Third-party apps already offer similar manipulation, and other phones such as the Samsung Galaxy S9 and LG G7 have shipped with blur adjustment first. Apple's post-shot bokeh looks sharp -- it's been getting better by degrees thanks to software tweaks since Apple introduced it in beta last year -- but you have to be in Portrait mode to get it. I don't often make my default because of its specific distance needs. Still, those of you who want even more customization when getting that perfect shot of a loved one -- or a pet! -- will have plenty to play with here.

Portrait Lighting effects, which digitally remove the background and turn selfies into head shots, now look slightly less artificial but are still hit and miss. The head shots I took with Portrait Lighting mode still look jarring on the edges.

Apple's speedier A12 Bionic chip is, as is often the case on brand-new iPhone chips compared to the year before, hard to compare in everyday use. It feels fast, but new phones often give that fast feeling before apps and wear and tear take their toll. Apps load somewhat faster in casual use. Early benchmarks don't always show great gains in straight-on speed: Geekbench 4 showed a modest bump, but 3DMark's Ice Storm Unlimited shows about a 50 percent improvement. Augmented-reality experiences might see the biggest leap on this phone in terms of speed, quality and performance. I can feel the difference, even before most apps have updated for iOS 12 and ARKit 2. AR apps I tried on both the X and XS had better, smoother video and higher-resolution backgrounds on the new phone. Apple says that's due to a greatly improved Neural Engine chip for machine learning and computer vision. All I know is the virtual dinosaurs looked better on the grassy hill I put them on. The puzzle boxes felt more realistic as I made them sprout from the ground. And the AR shoes sometimes looked so real through the phone screen that I reached out in reality and tried to move them with my hands.

Better water and dust resistance: These iPhones can stay water-safe an extra meter under water, up to 2 meters (6.5 feet) of immersion for up to 30 minutes. Last year's iPhones already survived up to 1 meter. This phone, according to Apple, will also better handle salt water, chlorinated water and various liquid spills. As always, the iPhone isn't expected to be an underwater camera, or a scuba companion -- but if this means it's more resistant to accidental dunkings, I'll take it. It passed CNET's tests perfectly. So far, these phones can handle drops better: CNET's iPhone XS drop tests show how durable the XS is compared to the X, which shattered really easily last year. That's great news. But by all means, put a case on your \$1,000 phone... you'd be crazy not to.

Advanced LTE and 4x4 MIMO could offer speedier connections in some cases: Apple didn't include 5G on the newest iPhones -- no current phones have adopted it, and it's not available from carriers yet anyway. (Expect it on more phones in 2019, and possibly in the 2020 iPhones.) In the meantime, these phones promise faster Gigabit LTE, at last -- something other phones have offered, but these faster speeds are new to the iPhone. On the test Verizon account I used, the iPhone XS delivers. I got download speeds of 250 Mbps in New Jersey, versus 170 Mbps using the same SIM in the iPhone X. My home broadband, by contrast, is only about 85 Mbps. The iPhone's now my fastest home internet device. The XS antennas could also help pick up signals better in borderline-coverage zones, but FYI: My NJ Transit commute still has dead spots on AT&T.

Face ID on the new phones is a bit better. When I first reviewed the XS, I saw somewhat faster Face ID log-in speeds. Now that iOS 12 is available for all phones, it seems like Face ID's advantages on the XS versus the X are marginal. Face ID still has moments where it doesn't recognize my face, or makes me use a physical passcode.

Dual SIM support: The ability to handle two SIM cards in the iPhone XS lets you use a physical nano-SIM plus an eSIM, which means you can have two different phone lines at once. But it's taking time for carriers to offer dual-SIM, and keep in mind that carrier-locked phones won't be able to add service on another carrier. Go with unlocked if you want the freedom to SIM-swap. Slightly improved wireless charging: Apple says the phone's wireless charging coil has improved so there'll be fewer misses when you place it on a charge pad. This could also mean faster charging in some conditions, but 7.5 watts is still the limit. I still notice that you have to make sure the iPhone is placed just right to charge up (as is the case with other phones, too). Apple promised its own fast wireless charging tech called AirPower in 2017, but that's still MIA. Meanwhile, Apple only includes a 5-watt basic Lightning iPhone charger in-box -- and yes, that's pretty annoying in a \$1,000 phone, especially since it can charge faster if you buy separate accessories. (The XR also has wireless charging.)

NFC can be scanned without launching an app: A new NFC chip in these iPhones means you can take an iPhone XS near an NFC tag, and it'll prompt launching a web page or app. But you won't be able to use the iPhone to instantly swipe into turnstiles or open doors yet.

Gold returns: The iPhone X shipped in only two colors, a stainless steel and white-backed silver model, and a nearly black space gray version. In the new gold version, the stainless steel rim is gold colored, but the back glass looks a subtle beige. If you want a more radical color lineup -- including coral, yellow and red -- go for the iPhone XR.

Video recordings look impressive: The added HDR (better auto contrast, as with the still photos) and extra stabilization made even my more casual videos look more vibrant, even at 1080p and 30fps. Walking with the camera in hand, shots often looked like I was using a stabilizing Steadicam device like a gimbal -- there was less shake and stutter. The microphones now record in stereo, too, but I didn't notice the difference in casual use. But in head-to-head tests versus the Galaxy Note 9 and the Pixel 3, the iPhone XS won out as a better video camera.

Speakers sound better: As with the iPhone X, the iPhone XS pumps out some solid stereo sound in landscape mode, but the XS takes it up a notch. I don't listen to things on my iPhone without headphones if I can help it.

These 2018 iPhones are the most expensive range in Apple's history. And on the XS side, we're now in \$1,000 phone land, like it or not. Many people I know don't like this at all. Some people find that a growing selection of midrange Android phones are more than good enough. The iPhone XR is a much better deal, but at \$749, it's still not anywhere near "budget."

For those folks, Apple is happy to offer its still-excellent older models, the iPhone 7 and iPhone 8 (and their Plus siblings), in the \$450-\$700 range. Even so, nearly everyone needs to spend the extra \$100 to get to 128 or 256GB from the entry-level 32 or 64GB models. Add an extra \$9 for the headphone dongle, now gone from the box on all new iPhones, and \$49 for a 29-watt USB-C Apple charger and \$19 for the USB-C-to-Lightning cable. Or, go the "affordable" route and get the \$19 12-watt iPad charger, at least. The point being, there should have been a faster charger in the box.

Apple could include more default storage and throw some of those step-up accessories in the box. Consider the Galaxy Note 9: It costs the same, steep \$1,000 starting price, but at least you're getting 128GB to start -- along with a stylus and a real headphone jack thrown in for "free." Oh, and you can double the storage with a microSD card for a mere \$30.

These new phones also get more expensive at the top end because of a whole new 512GB storage tier, something that only pro photographers and videographers should consider.

Better battery life. The XS lasts, according to Apple, 30 minutes more than the X. So far, in everyday use, it feels mostly the same. On our CNET offline video playback battery test, the XS lasted 13 hours, 17 minutes, which is better than the 11 hours, 27 minutes the X managed last year. The larger XS Max lasted considerably better, at 17 hours, 28 minutes. I still had to recharge the XS midway through the day to make sure I wasn't going to run too low on the train commute home. More gentle users may do fine with the XS battery, but I'd sacrifice a millimeter of thickness for longer battery life.

The XR beats them all at battery: 19 hours, 53 minutes.

The XS is an incremental step up from the iPhone X. Speed gains are hard to judge, and aren't nearly as dramatic at first as the X felt compared to the iPhone 7 of the prior year. The camera is certainly better, but the X already takes great shots. Battery life is close enough, and the XS' general design is identical. There isn't a good reason to upgrade from the X to the XS.

The exception to that rule may be the XS Max. iPhone X owners who want more screen real estate may find the 6.5-inch screen worth the cash, but that's strictly a personal preference.

For everyone else: Get the iPhone XR, unless you crave dual cameras and that OLED

The XS and XS Max are more polished, more advanced versions of the iPhone X. It's hard to imagine what more I'd want, except for the two notes I gave above. And, while the phone landscape has produced lots of great devices, the iPhone XS (and Max, which is basically just a larger-screened variant with the same internal specs) stand at the top. For their processors alone, they bleed potential. As a hub for the entire connected world, the iPhone XS feels like a perfect engine that you'll pay laptop money for.

But, these step-up models are luxury tiers. The phone you should now consider first is the iPhone XR. With its lower price, fast performance and a still great set of features, it's the one I'd suggest for nearly anyone. For those who want that extra 2x lens and that fancier OLED, and a touch of steel... sure, go for it. But if you see the iPhone XR and wish you'd saved some money instead, don't say I didn't warn you.

# Team Contribution

Elias Kraihanzel:	Topic Modeling and Web Implementation
Nathan Fitzpatrick:	Sentiment Analysis and Project Tutorial