Corrected Writing 1 (Claroni)

PictureComposer is a mobile app geared to assist photographers of all levels in taking the best photographs possible. While some make professional photography their full-time career, ameteur photography is abundant and on the rise. Photo sharing apps such as Instagram and VSCO foster over one billion users[1] and have created a platform where anyone can share their ameteur photography with the world. Whether the photo will be sold for a profit or posted on social media for popular viewing, many people care about taking a "good" photo.

There are many things photographers of all levels have to consider when capturing the best shot. From lighting, to focus, to composition, to exposure - the list is extensive. Applications that consider these photo qualities can greatly assist the photographer with capturing the ideal photograph. Currently, the camera application on an iPhone can detect the brightness of the camera's shot and help the user by turning the flash on for a better photo. Other existing smart camera apps can suggest filters for the user's photo to improve its final appearance. What's missing for photographers right now is an application to assist the user in identifying the perfect composition.

While composition is a rather subtle rule of photography to follow, we are creating our own rules of composition by developing complex technology that analyzes existing top-ranked photos. By developing this proprietary cutting-edge technology, the insight we provide in our app will be impossible to find elsewhere. We will be delivering this insight in a user-friendly manner, which will be accessible to Android users on the Google Play store.

We will be making the user experience a high priority from the moment they open our app. Once the user signs in, our app will allow them to take a picture with their phone's camera or upload an image that they have already saved. Next, our app will be able to detect the subject of a photo, and compare it to other highly ranked photos of the same subject. From there, our application will algorithmically determine a letter grade for the photo that suggests how well the photographer captures the optimal composition of their subject. The app will also provide three examples of similar photos that received higher composition grades. Each photo that the user uploads will be saved on their private profile to track their photo grades over time.

PictureComposer provides the unique feedback and grading on composition that photographers cannot get elsewhere right now. Our app fills an important need in the photography world, and has the potential to reach a very large audience.

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[1] Omnicore. *Instagram by the Numbers: Stats, Demographics & Fun Facts*. 10 February 2020. https://www.omnicoreagency.com/instagram-statistics/.

Corrected Writing 1 (Fiore)

Photography is nearly ubiquitous in the modern world. With the prevalence of smartphone cameras, taking a photo is more accessible than ever before- be it of your pet, a picturesque view, or even yourself. As such, we take millions of pictures globally each day and upload over a billion to social media platforms[2].

Photo sharing applications like Instagram and Flickr allow users to share their shots with a potentially vast audience. These platforms host a variety of creators, from hobbyists to world-renowned photographers, like Annie Leibovitz. Furthermore, they serve as a portfolio for both emerging and experienced photographers to showcase work and connect with clients.

PictureComposer aims to help photographers of all skill levels take better photos that attract attention. Leveraging data from photo sharing platforms and the principles of photography, we plan to develop a mobile application where users can upload a photo and receive tailored advice on improving image composition, allowing anyone to take visually appealing, professional quality photos. We intend to offer the following features:

Photo Grading: An uploaded image will receive a letter grade for composition. A grade breakdown will be presented, enabling the user to review opportunities for improvement, as well as the strengths of their photo. The breakdown will provide specific recommendations for adjusting composition- for example, positioning the subject matter to the left rather than the center, or zooming in on the subject so it occupies a greater portion of the image.

Similar Images: Our application will curate three (3) popular images of a similar subject for the user to review. The user may view the suggested images' performance on Flickr, including ratings and comments. This feature will allow for valuable comparison between the user's own photo and highly successful photos of the same or similar subject, providing both inspiration and a guide for future pictures.

Performance Prediction: Given that social media is a primary avenue for advancement within the photography industry, building a successful Instagram account can be key for professional growth. Receiving high engagement on posts is paramount for reaching a wider audience and potential clients. However, it can be difficult to predict which photos will perform well. In fact, a simple web search reveals millions of results claiming to boost engagement with unsubstantiated tips and tricks. We intend to offer a data driven solution that will predict the performance of a photo and provide valuable insight for users working to boost their social media presence.

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[2] Mary Meeker, "Internet Trends 2014 – Code Conference," KPCB (Presentation, Re/Code Code Conference, Rancho Palos Verdes, CA, May 27, 2014).

Corrected Writing 1 (Syquia)

With the advent of technology, it is becoming increasingly common to see visually appealing images with ultrahigh resolution. Photography is no longer restricted to dedicated digital cameras. We have cameras embedded with nearly every smartphone readily available in our hands. As a result, we share photos over billions of photos per year on social media platforms.

Photography in social media platforms is an integral aspect feature in applications like Snapchat, Facebook and Instagram. Each of these photo sharing applications leverage photos to connect creative and non-creative people around the world. Furthermore, the visual collection of their images allows users to engage and connect with their audience.

Our application *PictureComposer* is a creative tool that aims to provide creators help in capturing visually striking pictures. We derive data from images generated in Instagram, Flickr and other photo sharing applications to analyze and provide the user with real-time feedback and suggesting improvements to their photos included but not limited to composition, lighting, exposure, and focus. Other photo applications on the other hand such as VSCO only focus on suggesting photo filters. As such, users will receive suggested improvements to the composition of their photos based on highly curated photos which has never been done before. Our application will provide the four main features:

Real-time Subject Tracking and Photo Grading Feedback: Using real-time object detection, the user can visualize and track where the subject of their photos will be. Fundamentals such as aligning the camera to the horizon and adjusting overexposed or underexposed scenes will be suggested to the user. Users choose the category of the subject such as a dog or a mountain they intend to capture and upload for a letter grade feedback. The letter grade breaks down into different sections to improve the photo based on collected images of the same category. Sections include composition placement, subject alignment, exposure and lighting quality. For example, the user may be suggested to align the photo to the right of the frame to improve the composition of the photo.

Photo Suggestions: Our photo application provides the top three curated similar photos and expands on the photo grading feedback to further validate feedback suggestions.

Popularity Analysis: Feedback will include the popularity analysis of the user captured image based on the same subject category. Our application provides popularity rating predictions on the photo based on how it will perform on different platforms like Instagram, Flickr, and Facebook. This aspect is intended to provide users with improvements in the professional industry and gain insight on feedback that will boost user engagements.

Personalized Photo Account: Users can create an account where previous photos will be stored on our database. Photo Grading feedback will reference to this and keep track of user improvements throughout the collection of their photos.

Corrected Writing 2

Similar Projects

Similar Projects: Like *PictureComposer*, there are other photography applications that utilize artificial intelligence to improve a user's photos.. Among these, the most notable integrations of AI in photography are *VSCO* and *Photoshop Camera*. *VSCO,* a popular photo editing and sharing application*,* offers a *For This Photo* feature, which uses machine learning to suggest relevant filters that best suit a given photo. Similarly, Photoshop Camera, an Adobe application, recommends the best lenses and filters for your photos before the photo is taken. While these applications share some similarities with *PictureComposer*, namely that they improve the user's photos, our application differs greatly in its approach and functionality.

Project Dissimilarity: While the applications mentioned above address the question of "How do I make my picture better?", *PictureComposer* strives to answer "How do I take a better picture?". Unlike VSCO and Photoshop Camera, our application advises users on how they can better their photography, rather than just add filters. Our project invites users to take professional quality photos by applying and utilizing photography principles to create a visually appealing composition. Approaches by both *Photoshop Camera* and *VSCO* rely on post-processing features that manipulate photos, while our application will suggest appropriate photography principles and inspire users with similar highly ranked photos. As such, our project represents a novel approach to photo taking.

Impact Significance: The impact of our project's unique feedback and grading system on the composition pose encouragement to incoming and current creators interested in photography. Not only will it aid users in capturing better photos, but it will provide intelligent feedback and guidance not offered anywhere else.

Target Audience

Target Audience: We intend to target every Android user that utilizes their camera. However, while photographers of every level may use our product, our primary target audience is amateur photographers. Our secondary target audience is professional photographers, as advanced photographers may prefer to take photos off-device, but can still upload to our application. However, both amateurs and professionals could benefit from taking test photos to receive feedback while shooting.

Affordability: Our application will be priced at $1.99 on the Google Play store. Because we intend to market this product to users of varied income levels and backgrounds, particularly those entering the creative field, affordability is key. This one time fee of $1.99 will keep the app accessible, while covering nominal costs.

Feasibility: It is feasible for our audience to use our product because, in the age of social media and high quality smartphone cameras, photographers across skill levels often take photos directly on their device for easy shooting, editing, and uploading. *PictureComposer* integrates easily into this existing posting pipeline. Professional photographers may use different equipment for

taking photos, but still often upload to smartphones for editing or posting purposes, making our app still feasible for this group.

Business Model: We will have a gross profit of $1.99 per download. Google Play will take 30% of each sale, and we will have to pay a one-time $25 developer fee to publish the app to the store. As such, we will begin profiting upon reaching our eighteenth download.. After that point, we will make a net profit of $1.39 per download.

Awareness: We will offer Instagram influencers our app for free so they can market it for us and encourage more downloads from their large following. We will also create our own social media presence to showcase our application.

Societal and Global Impact

Societal Need: Google's android application store, *Play Store*, reached 2.5 billion active devices in 2019[3], representing a third of the global population. Across this undoubtedly diverse user base, photography is unparalleled in its ability to transcend cultural barriers. While the prevalence of Android, particularly in emerging markets, has made taking photos far more accessible, there is limited instruction on exactly *how* to take a good picture. Traditional photography classes are often expensive, time consuming, or simply unavailable. *PictureComposer* will address this need, providing valuable feedback and instruction to photographers of every level.

Global Outcomes: With the emergence of social media platforms, anyone can share their images with a global audience. PictureComposer will enable users to leverage these tools into a viable career. The global photography services market is growing and fragmented[4], signifying high opportunity and low barriers to entry for those breaking into the field. Our application will provide the skill set for photographers of any background and education to monetize their work, expanding professional opportunities in communities around the world.
PictureComposer is a powerful tool for hobbyists, as well. Especially now, in the midst of a global pandemic, photos allow us to stay connected with family and friends, even when we can't be together. Capturing special moments, particularly for those who can't be there, has never been more important. Our application will enable anyone, regardless of skill level or technical knowledge, to take better pictures they can feel confident sharing- joining people together regardless of location.

Concerns and Regulation: PictureComposer only allows users to assess and receive feedback on their own images. While security will be emphasized to ensure that the photos users save to their accounts are protected, there is little need for regulation. Unlike social media platforms, or any application with photo sharing features, there is no way for users to interact with each other within the application to spread potentially harmful content. In addition, unlike other photo editing tools like FaceTune or Photoshop, *PictureComposer* can't be used to maliciously change or distort images.

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[3] Russell Brandon, "There are now 2.5 billion active Android devices," (The Verge, 2019).
[4] Jesse Maida, "Global Photography Services Market 2019-2023," (Technavio, 2019).

Writing 3

Project Milestones and Timeline

	30% (11/24)	40% (12/09)	70% (1/20)	90% (2/24)	100% (4/7)
Brooke:	-Add features to login/sign up screens (loading bar, disable touch, remember me, forgot password) -Support custom queries for Pixabay API call and display 3 most popular images from that query -Support the storage of more than one photo per user	-Polish design on login/sign up screens -Add menu screen for signed in users -Store the 3 Pixabay images in the database -Support the storage of a fake subject word for each photo -Support the storage of fake bounding box coordinates for each photo	-Add splash screen to appear at app launch -Support the storage of bounding box coordinates for each photo -Support the storage of the real subject word for each photo -Design non-working portfolio screen	-Design app icon -Support the storage of a detailed grade breakdown & metadata for each photo -Add functionality to portfolio screen -Enable 3 pixabay photos to be clicked and routed to the original post	-Switch login/sign up features from test settings to deployment settings -Add clear & detailed error messages for networking calls
Giana:	•Design the grading interface, including grade, description, and Pixabay image section •Provide a basic sample grade breakdown for a provided test image	•Implement preliminary framing algorithm, using test data •Implement exposure checking and associated recommendations using histogram data	•Replace all temporary test data with real data from Jekko, including subject bounding box and classification •Populate grading screen with Pixabay photos from Brooke	•Implement leveling/straightening checking algorithm, likely with Hough Line transform •Implement blur detection algorithm	•Refine previously implemented algorithms for robustness •Ensure edge cases are handled and proper error messages are relayed to the user
Jekko:	-Migrate from ML Kit Object detection to Tensorflow framework to support custom object detection. -Transfer learning on the SSD with Mobilenet using a small set of custom categories.	-Support simple image fetching and running the object detection on the image. -Retraining the model. -Polish design on the graphic and display the label for the subject. -Populate category database.	-Transfer learning models on bigger categories such as the COCO dataset. -Design camera Interface for capturing photos. -Support storing image, bounding box/subject to the database.	-Support landscape orientation. -Detect multiple people -Object detection confidence 90%	-Multiple subject detection.

Technical Innovation

Novelty: Our application utilizes machine learning specifically the use of Tensorflow API to detect the main subject and suggest ways to take better photos. Other applications aim to make better photos through manipulation of photos after they are taken. Our application's customized feedback aims to guide users through fundamental qualities that make a better photo.

Similar Projects: Like *PictureComposer*, there are other photography applications that utilize artificial intelligence to improve a user's photos. Among these, the most notable integrations of AI in photography are *VSCO* and *Photoshop Camera*. *VSCO,* a popular photo editing and sharing application*,* offers a *For This Photo* feature, which uses machine learning to suggest relevant filters that best suit a given photo. Similarly, *Photoshop Camera*, an Adobe application, recommends the best lenses and filters for your photos before the photo is taken. While these applications share some similarities with *PictureComposer*, namely that they improve the user's photos, our application differs greatly in its approach and functionality. We aim to provide ways to take better photos and avoid approaches that manipulate the pictures in any way.

Technical Feasibility

Database: For the database features, we are implementing Firebase technologies. This includes Firebase Authentication service for account creation, management, and login. This also includes Firebase Storage for storing the image files taken by the user and Firebase Realtime Database to store metadata for each image. This is an achievable workflow for the backend since Firebase and Android work seamlessly together, and the tiered pricing enables scalability.

Networking: We will also be implementing Pixabay's RESTful API to provide the user with three popular royalty-free photos of the same subject that the user captured. This API allows 5,000 requests per hour which suits our small-scale needs.

Object Detection: We are implementing Tensorflow Lite as the framework for object detection on Android mobile devices. We are using Tensorflow to implement transfer learning on the object detection model SSD-Mobilenet v1 with our custom database that abides to specific categories. Using Tensorflow Lite enables on-device machine learning inference with small latency and prevents the need of using a server to perform object detection.

Image Processing: To process images for our photo grading feature, we are using OpenCV, an open source computer vision library. OpenCV provides extensive image processing functionality, which we will integrate with our own algorithms that apply the photography principles expanded upon in previous writings. OpenCV offers extensive documentation and tutorials, which make its offerings highly accessible.The library can be imported as an Android module and serves as an all encompassing computer vision solution for our project. With access to this highly versatile tool, we have confidence in the feasibility of our photo grading algorithm.

Cost, Risks, and Risk Mitigation

Software Costs: PictureComposer is developed with Android Studio, a free IDE, using Android emulators primarily. We use the free tier of Firebase services, made possible by the scale of our project. OpenCV, MLKit, TensorFlow Lite, and Pixabay API are also free. We collaborate using Git's free version control solution. As such, we estimate a total software cost of $0.

Hardware Costs: While the majority of development can be accomplished with Android emulators, we will need physical android devices to test functionality that uses the device camera. As such, we intend to purchase three Android mobile devices — one for each team member — given that we must work remotely. As this is our only hardware requirement, we estimate a total hardware cost of $300 for three Android smartphones that support the minimum Android API Level 21.

Lines of Code: We estimate that our project will contain approximately 10,000 lines of code. Our current skeleton has 6,269 lines of code, and individual test applications contain about 2,000 lines. We estimate that the implementation of additional functionality will account for about an additional 3,000-5,000 lines of code. Conversely, integrating our applications under one skeleton will minimize duplicated Android code. As such, we can reasonably conclude that, at the end of development, we will fall around 10,000 lines.

Risks and Mitigation: We have identified a number of risks in the early stages of development, which we will work to mitigate throughout our project's lifespan. Namely, we recognize that, should we encounter major issues with our frameworks, libraries, and APIs, our project would suffer significantly. To mitigate this, we conducted extensive research to confirm the integrity of the tools we've chosen, and will remain up to date on releases and documentation. Second, we are mindful that, as "lines of code" increases, so does the likelihood of bugs. As such, we will prioritize writing concise code, evident in our 10,000 line prediction, and minimizing complexity where possible. Finally, we estimate that one of the greatest risks associated with our project is the time constraints of this course. To mitigate this, we intend to follow the timeline outlined above and achieve timely completion.