

## Problem Statement

- Inconsistency on amazon images or misinterpretation by the user
- Customer is not completely satisfied because he cannot describe the needs of his requirements
- More likely than not, you've worked with a client with sky-high expectations who want nothing but the best which is a limitation of current technology
- Not providing a real-time try-on is a major limitation of online shopping right now especially while purchasing fragile products such as the furniture or clothes which are to be tailored .
- Oftentimes, you only have pictures or a floor plan to try and express the feel of an entire room. It's hard to sell something that doesn't physically exist which in reality requires a customer-fit experience.
- Not all images are going to have their 3D models for augmentation , this is a clear sign of lack of resources which needs to be rectified.

This can lead to -

- Poor shopping experience and products received are different from expectations
- Wastage of resources of Amazon in providing the 14-day no questions asked return.
- This fritters away the customer's precious time which can lead the customer to switch to department stores for a more realistic shopping experience.
- Not all products can be augmented therefore the whole purpose of Augmented reality fails.

## Solution

- We will be making the shopping experience rich for the users of Amazon by providing Augmentation Reality environment with Machine Learning pattern recognition and recommender system for maximum satisfiability with exposure matched like no other.
- The elaborative potential of this emerging technology will be guaranteed to provide the customer a tailored shopping experience for maximum easiness.
- Augmented reality is the revolutionary solution to the constraints faced by customers and retailers of Amazon in visualizing the actual product like never before. AR helps the customer visualize the product even before it is developed which saves time and resources.
- Using AR in interior design gives an ability to the user to design the space the way they want. An effective AR visualization for the customers will help in accelerating the purchase and designing process along with increasing the probability of making the purchase from Amazon successfully with minimum urge to look around making Amazon a one-step solution to all interior design solutions.
- Machine learning will recognize the operational patterns of the preferences of the customer based upon his fondness of products as well as the attributes we will pick from his environment and develop upon them to predict and recommend new products which will cater his needs to the maximum possible extent.
- With our Neural networks model, we will be able to synthesize personalized suggestions picking up from the data stored in our dynamic database to save the history as we go for a long term solution.

## Frameworks/Technologies stacks to be used

### Technology used

#### Explain why we used the technology

**Django** - Interface

**SQL** - Database to store user information

**Jupyter** - Running Machine Learning algorithms

**C# and Unity** - #Rishi

**Javascript**

**Amazon S3** - Storing the images of products provided by retailers

**Amazon EC2** - Deploying Django app to the linux AMI for 24x7 pay-as-you-go server architecture

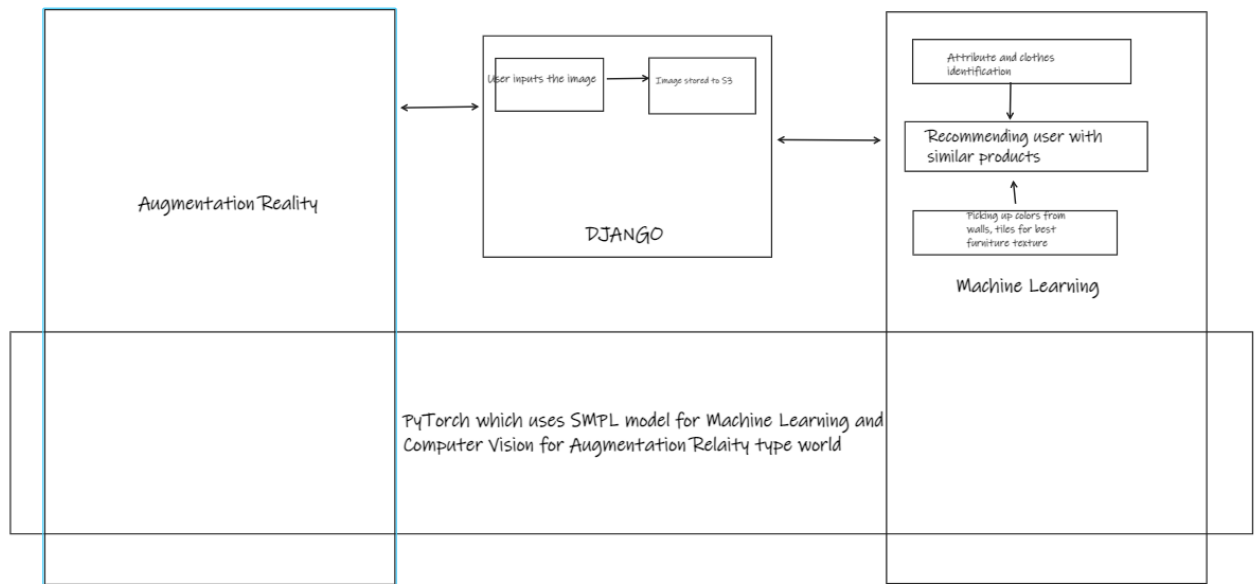
**Pytorch** - Creating Computer Vision software for virtual 3d tryon

**TailorNet** - Drape clothes on the human body depending upon their postures, style and shape of their body.

### Architecture

<https://wbd.ms/share/v2/aHR0cHM6Ly93aGI0ZWJvYXJkLm1pY3Jvc29mdC5jb20vYXBpL3YxLjAvd2hpdGVib2FyZHMvcmVhZGVtL2ZhZWQzZjExMmRiNzQxYjk5Mzg4N2NhOTIhNmIwZDQyX0JCQTcxNzYyLTEyRTAtNDJFMS1CMzI0LTVCMTMxRjQyNEUzRF9mM2QxYWNkOC03OGJjLTQ5YzgtYTYzMCI0MjZGU2MjRjN2RIOTY=>

- Django inputs the user's favorite clothing image
- Machine learning identifies the features of the clothes and saves in the database
- Second ML model finds similar products related to the liking using neural networks
- User selects the best recommendation and downloads the file



## Extent to which this application will be used

This project is developed for a large scale

In this modern era almost everyone has access to smart devices and since our application is also mobile based thus it would be available for most of the people to use . Whoever wants to have a personalized shopping experience can make the best use of our application according to their desired dimensions without worrying about their body dimensions.

For Interior Design purposes our application can provide great features of intriguing the interiors virtually through our application.

## How tough is to implement this idea

Definitely not a straightforward approach but with extensive approach we will begin to improvise The Augine as we have done so far

## Concepts Used

- 1) Person image synthesis(computer vision): we have to synthesize the AR image of the person.
- 2) Tracking of human body parts takes place , makes bioframe and then reconstructs .
- 3) Thus, we only need the dataset that contains personal images  $\{I \in \mathbb{R}^{3 \times H \times W}\}$  with each person in several poses. The corresponding keypoint-based pose  $P \in \mathbb{R}^{18 \times H \times W}$  of  $I$ , 18 channel heat map that encodes the locations of 18 joints of a human body, can be automatically extracted via an existing pose estimation method..

## Django

A Product model is created which will store the information about the products available in the database.

Product Model stores the following information:

`{'name', 'category', 'price', 'product description', '3D model of product'}`

User data would be collected by our machine learning model and will be stored on the backend.

Based on the user data another machine learning model would suggest and recommend items to the user.

Django is a high-level Python web framework that **enables rapid development of secure and maintainable websites**. Built by experienced developers, Django takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel.

## Database

SQL

## Unity

# Machine Learning Model

This is a two phase model which first inputs the preferences of the user and tracks the (likings) of the user in the domain of fashion.

## Step 1: Identify what kind of clothes the user likes to wear

Information:

<https://github.com/switchablenorms/DeepFashion2>

<https://arxiv.org/pdf/1901.07973.pdf>

Implementation:

<https://manishsinghrajput96.blogspot.com/search/label/Deepfashion2%20Dataset%20implementation>

This ML model identifies the clothes worn by a user by performing tracking of environment from a given image using Computer Vision

13 popular clothing categories for detection, segmentation

'short\_sleeved\_shirt', 'long\_sleeved\_shirt', 'short\_sleeved\_outwear', 'long\_sleeved\_outwear', 'vest', 'sling', 'shorts', 'trousers', 'skirt', 'short\_sleeved\_dress', 'long\_sleeved\_dress', 'vest\_dress', 'sling\_dress'

- **Object tracking is a deep learning process where the algorithm tracks the movement of an object.** In other words, it is the task of estimating or predicting the positions and other relevant information of moving objects in a video. Object tracking usually involves the process of object detection.

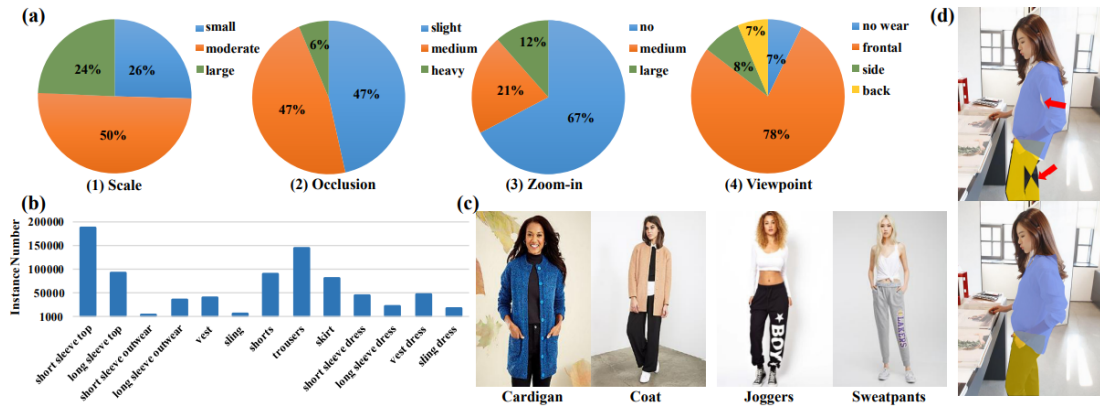


Figure 3. (a) shows the statistics of different variations in DeepFashion2. (b) is the numbers of items of the 13 categories in DeepFashion2. (c) shows that categories in DeepFashion [14] have ambiguity. For example, it is difficult to distinguish between 'cardigan' and 'coat', and between 'joggers' and 'sweatpants'. They result in ambiguity when labeling data. (d) **Top:** masks may be inaccurate when complex poses are presented. **Bottom:** the masks will be refined by human.

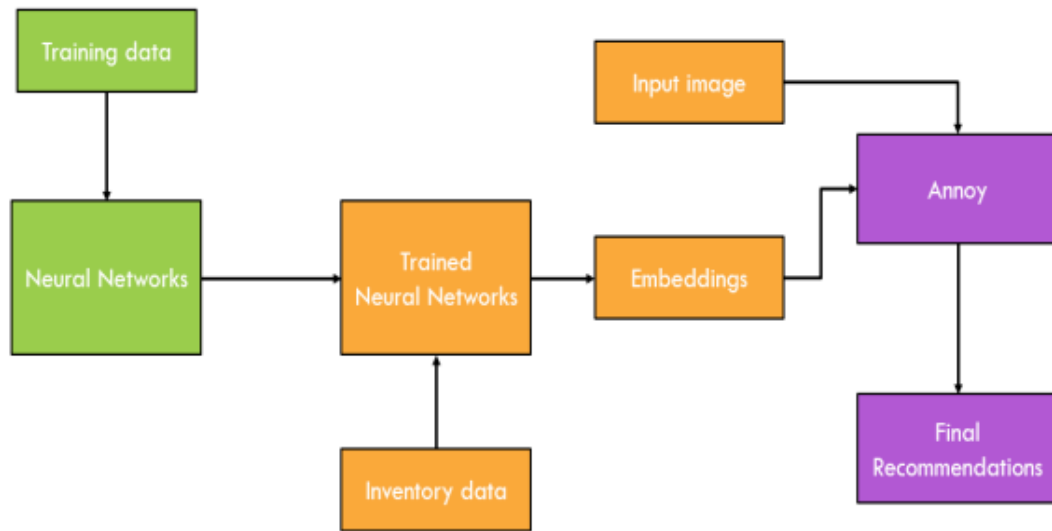
- The dataset is split into a training set (391K images), a validation set (34k images), and a test set (67k images).

The algorithm used to implement is called Mask R-CNN which extends Faster R-CNN by adding a branch for predicting an object mask in parallel with the existing branch for bounding box recognition. Mask R-CNN is simple to train and adds only a small overhead to Faster R-CNN, running at 5 fps. Moreover, Mask R-CNN is easy to generalize to other tasks, e.g., allowing us to estimate human poses in the same framework.

## Step 2: Recommend similar apparels

We will generate a personalized recommendation from these preferences of each individual and then use <https://github.com/sonu275981/Fashion-Recommender-system> to recommend other similar products based upon the liking and previous preferences using Neural Networks.

**To generate recommendations, our proposed approach uses Sklearn Nearest neighbors**



**Figure 1.** Block diagram of proposed system

ML Model 2: Picking the colors of the garments from the skin, eye, hair complexion of the user.

<http://devmag.org.za/2012/07/29/how-to-choose-colours-procedurally-algorithms/>



# TAILERNET USING PYTORCH

- 1.) In this project, we are taking the help of a neural model named Tailornet, which basically predicts clothing deformation in 3D as a function of three factors: pose, shape and style (garment geometry), while retaining wrinkle detail.
- 2.) According to the study, we find that combinations of examples smooth out high frequency components such as fine-wrinkles, which makes learning the three factors jointly hard. Since it's hard to study all three factors jointly thus our technique is to decompose the deformation into a high frequency and a low frequency component.
- 3.) So, the low-frequency component is predicted from pose, shape and style parameters with an MLP (which is basically a feedforward artificial neural network) and the high-frequency component is predicted with a mixture of shape-style specific pose models.
- 5.) Now, the weights of the mixture we obtained are now computed with a narrow bandwidth kernel to guarantee that only predictions with similar high-frequency patterns are combined. The style variation is obtained by computing, in a canonical pose, a subspace of deformation, which satisfies physical constraints such as inter-penetration, and draping on the body.
- 4.) High frequency geometry is predicted with a mixture of high frequency style-shape specific models, where each specific model consists of a MLP which predicts deformation as a function of pose, and the weights of the mixture are obtained using a kernel which evaluates similarity in style and shape
- 6.) So, what we will do is we will take the data of different postures and poses of the body with the help of 55800 frames provided in this dataset [https://github.com/zycliao/TailorNet\\_dataset](https://github.com/zycliao/TailorNet_dataset) provided in this link. Now, physics based simulations (PBS) which will be trained and learned from this dataset will eventually retain the wrinkles and then TailerNet will deliver the 3D garments according to those wrinkles .
- 7.) So, the user will be provided with the clothing according to different postures so that he/she can check the fitting and dimensions of clothes according to their need.

## HOW WE WILL ACHIEVE THIS ?

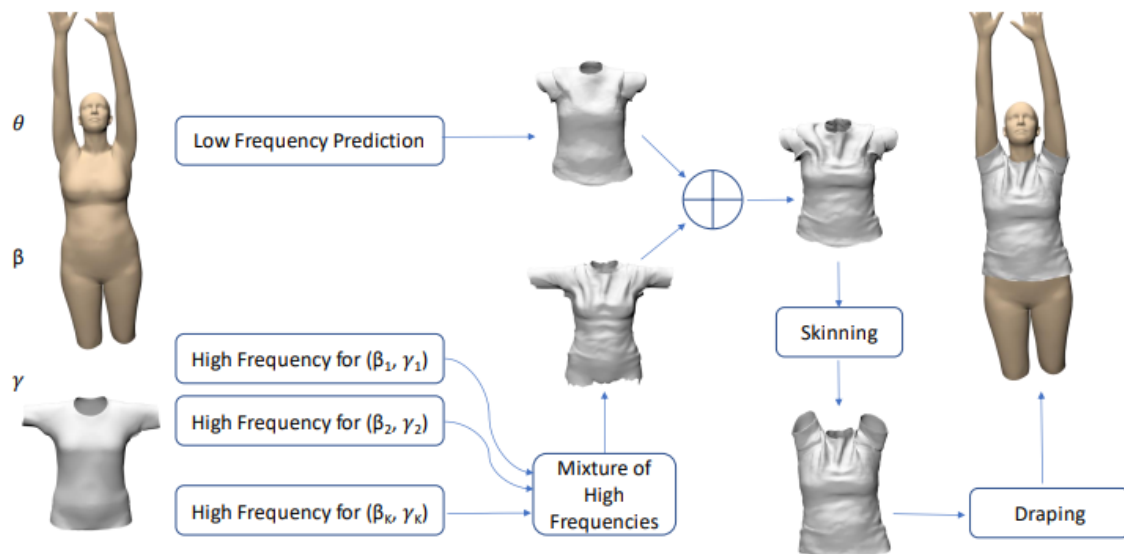
- 1.) In the same spirit as SMPL, which is a realistic 3D model of the human body that is based on skinning and blend shapes and is learned from thousands of 3D body scans, TailorNet learns deformations as a displacement to a garment template in a canonical pose, while the articulated motion is driven by skinning. TailorNet can either take a real garment as input, or generate it from scratch, and drape it on top of the SMPL body for any shape and pose.

2.)To generate different garment styles in a static pose, we basically compute a PCA subspace using the publicly available digital wardrobe of real static garments. Also, To generate more style variation while satisfying garment human physical constraints, we sample from the PCA subspace, run PBS for each sample, and recompute PCA again, to obtain a static style subspace. Samples from this subspace produce variation in sleeve length, size and fit in a static pose.

3.)To learn deformation as a function of pose and shape, we generated a semi-real dataset by animating garments (real or samples from the static style subspace) using PBS on top of SMPL body for static SMPL poses, and for different shapes.

4.)We will implement tailernet using Pytorch with the help of this github link :

<https://github.com/chaitanya100100/TailorNet>



## WHY TAILERNET ?

1.) In contrast to classical PBS, TailorNet is easy to use and fully differentiable, which is crucial for computer vision and learning algorithms while running more than 1000 times faster than PBS.

2.)Our first observation is that, for a fixed style and body shape, predicting high frequency clothing deformations as a function of pose is possible – perhaps, we find that, for this task, a simple multi-layer perceptron model (MLP) performs as well as or better than Graph Neural Networks. In stark contrast, straightforward prediction of deformation as a function of style, shape and pose results in overly smooth un-realistic results. We hypothesize that any attempt to combine training examples smoothes out high frequency components, which explains why previous models even for a single style, lack fine scale wrinkles and folds.

These key observations motivate us to make the design with the help of TailorNet.

## What are the impact metrics that one can use to analyze the effect of the solution?

### **Boosted sales**

Customers like to see what they're getting — that's why they often tend to purchase an item in a physical outlet rather than an online store.

AR picks up that approach and takes it to the next level by letting customers see how the product will look at their place.

According to reports, more than 70% of customers say they would purchase an interior **design** product if they could see how it looks at their place.

By letting your potential customers see what they're getting, and how the result will turn out to be, you're essentially boosting your **sales**.

## Increased customer satisfaction

Customers often don't get satisfied before they see the results. And without the use of AR and Machine Learning, it's not possible to give them that information beforehand. Sometimes, customers even turn out to be disappointed with the results and might request a revamp. In such cases, the customer might feel tired up and decide not to work with you for any future alliance.

Our project takes care of that problem and lets customers see and get satisfied with a **outcome** before it's put in place. That way, they're very likely to be satisfied with the end results and be loyal, returning customers. Needless to say, loyal customers are a blessing and you must get them at any cost.

## High productivity in workspaces

**Coworking spaces** are busy and must be designed with extreme care for maximum productivity of the coworkers. Using **augmented reality**, it's possible to visualize and **design** a coworking space just like the manager wants it.

Neatly and precisely designed working spaces let the employees perform at their best by eliminating distractions. Ultimately, they get things done faster and more efficiently, boosting the productivity of the entire workspace in the long run.

## Effective remodeling

You know things could turn out to be tricky when a customer wants to remodel one of their rooms, let's say the bathroom, and can't explain the requirements effectively. It makes it hard for you to work on the project and **design** something that'd fit their requirements.

With AR, you can make sure you're on the right path by communicating the **design** back and forth. For example, you can **design** a **shower replacement** and show it to your client with AR. If they approve, you can go on to install it in their bathroom.

## Competitive advantage

In the modern world of 2021, companies that embrace new technologies get ahead — and the ones who don't — are left behind. The same goes for firms in the interior **design** niche. Embracing AR gives you the competitive advantage you need to excel in your field and achieve the desired level of success.

With AR, you can accelerate your workflow as you wouldn't have to spend a lot of time explaining to customers what they're getting; you can just show them. It enables you to be more efficient with your time and market your services to be faster than the competition.

## Fashion

77% of AR users said they use it to see product differences, such as possible variations of colors and styles. AR allows them to do this up-close, at different angles and in their own space.

## AUGMENTED REALITY DRIVES CONSUMERS TO MAKE IMPULSE PURCHASES

### **Saves Time**

It has been found that customers have to wait in long queues in order to purchase their desired products, they have to wait for their turn to try on these apparels thus leading to wastage of customer's precious time.

### **Personalized Shopping Experience**

To meet up with the new trends one wants to try different fashion products ,but it has been discovered that most of us don't get satisfied with the products we buy ,as they do not meet our expectations.But AR can help to virtualize the in-store experience, enabling customers to see and interact with realistic, virtual product models through their smartphone device. With 62% of shoppers who have used [clothes virtual try on](#) stating that it encouraged them to

make a purchase, the technology could finally bridge the gap between online and in-store conversion rates.

## Solution

Augmented reality in interior design is the revolutionary solution to the constraints faced by clients and designers in visualizing the actual project like never before. AR in [interior design](#) help the client visualize the project before it is developed. Using AR in interior design gives an ability to the user to design the space the way they want. An effective AR visualization for the clients will help in accelerating the purchase and designing process along with increasing the probability of closing successfully.

Machine Learning: Creating 3D images out of 2D images

3D design is used by many industries and can be used in architecture to draw plans for buildings as well as being used by eCommerce brands to provide a realistic design of a product to consumers. Additionally to having uses within different industries to target consumers it also provides a great deal of use to manufacturers of what the final product is expected to look like once it has been made, helping the manufacturers match the made product to the expectations of the designer/ client.

## ●How it helps to solve the problem?

### Augmented Reality

1. Augmented reality software for interior design is aimed at simplifying customer communication, accelerating plan approval and deal closing, as well as reducing purchase return rates by **50-70%**.
2. Better Visualization – AR in [interior design](#) help the client visualize the project before it is developed. Using AR in interior design gives an ability to the user to design the space the way they want. Be it a rustic, beach or boho style home, AR will let the user visualize that all in a go. A mobile phone or a tablet loaded with samples is all needed to transform the userspace.
3. Design editing abilities -User will also get an ability to edit the designs and make changes even if the design is at the final stage. So, now users need not worry about the tedious corrections that are done in actual décor and furniture.
4. Better guidance– AR in interior design will let a user guide the designer in the best possible manner. Even the minute details related to the designing process can be communicated interactively using AR.
5. Find and try products remotely – The clients can try various products for their new project such as the furniture without paying a penny.



## Machine Learning:

- **Faster product design (roughly 45% faster on average) allows you to beat your competition to market**
  - More effective communication with suppliers/customers
  - Visualize more 'what-if' scenarios during the design process
  - Automatic flattening of sheet metal parts (with bend allowance)
- **The ability to create renderings and animations for design proposals or reviews**
  - More effective internal design reviews
  - Create effective sales and marketing content
- **Simulation, test and validate your designs to reduce costs from quality problems, errors, ECO's**
  - Virtual prototypes reduce the need and cost of physical prototypes
  - Helps you ask and answer complex and important engineering questions earlier
- **3D print prototypes allows everyone to participate in the process**
  - Easily incorporate late design changes
  - Test your design in the real world before moving to production
- **Data management to organize and manage your design data**
  - Automatic Bills of Materials
  - Helps to standardize on detailing and drafting practices
- **Automate your design process and increase speed and accuracy of output and response to customers**
  - Allow non-technical personnel such as sales department (and even customers) to quote, specify and configure product whilst maintaining your design and engineering integrity
  - Automatically generate 2D and 3D drawings of your 3D models

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some benefits of using **augmented reality** in interior **design**.

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### ● Assumptions, constraints, and solution decision points (Reason behind choosing a technology)

Unity has custom resources to bring your immersive vision to life. Our industry-leading software development platform pairs tools purpose-built for Augmented Reality creators and a unified workflow across devices that lets you focus on pushing the boundaries of your imagination.

#### AR Foundation

A framework purpose-built for AR development allows you to develop your app once, then deploy it across multiple mobile and wearable AR devices. It includes core features from each platform, as well as unique Unity features that include photorealistic rendering, physics, device optimizations, and more.

## Constraints:

1. Hardware issues: Currently, every available AR headset is a bulky piece of hardware that may be too expensive for the masses. Also, a majority of AR headsets need to be tethered to a computer, making the entire experience limited and inconvenient. Alternatively, consumers can use their smartphones or tablets for AR applications. However, mobile AR faces major issues in displaying visuals accurately. For instance, mobile sensors such as accelerometer can be disturbed by electric interference, which is commonly witnessed in urban areas. Additionally, smartphone cameras are built for 2D image capture and are incapable of rendering 3D images. Hence, the hardware required for AR technology needs to be enhanced before mass adoption.

# SOCIETAL IMPACT OF AR + AI/ML

Earlier marketing forms needed a makeover with time as so many technological developments and demand and supply for goods were increasing. Retail shops grew bigger, more people flogged in and the system became more organized. Here are some points that highlight the overall issue:

1. **Traveling-** The latest impact of the coronavirus pandemic on retail is a ubiquitous example. While in this lockdown phase, people have to stay put and only go out to buy necessary items, there is always a threat of coming in contact with an affected person.
2. **Compartmentalization-** Although, this isn't a problem but it can pose as one. Continuing with the above example, the more time you spend going through various compartments for production, time is wasted and the risk of contracting the disease increases.
3. **Insufficient items-** One recurring limitation of traditional retail business that you constantly face is items not in stock and you don't find that out unless you visit it. In times like these with limited resources and mass hoarding, the problem has become fourfold.
4. **Money to setup-** A brick and mortar retail store is always a costly investment. For SMEs, it may mean risking everything that they have. Therefore, no consumer means loss in businesses which results in winding up of the business.
5. **Limited working hours-** Unlike online shopping, shops have fixed business hours. And during stressful times like these, policies have become stricter. There may be times when you have to search (properly) and choose which item(s) should be on your cart but you don't always get that much time.

## **How AR will help in changing the game ?**

### **Reduces hygiene issues**

With the outbreak of Covid-19, germs and social distancing have become a major concern. Online sales have been higher than before to avoid cross-contamination. Thus, AR shopping experiences while sitting at home are as close to real-life shopping experiences as possible. Even in stores, Augmented Reality marketing strategy reduces the need for products to be handled and touched with “Try On” and “Try Out” features. Overall, integration of AR in the retail sector is helpful for the hygiene issues that are at the forefront of customers’ minds and thus have great impact on economy and sales of the product even during any pandemic.

### **Cost of products/ Retail Price**

Today’s manufacturing of products takes in this whole way that products gets manufactured first in factory and then they are transported to retailers , then shops and malls and finally to the customer. All of this leads to increase in cost of products making sometimes unaffordable.

Thus, with the help of AR , products can directly be put on the website ,and users can take the benefit of virtual try on and ordering their products directly from factories which indirectly helps in reduction of retail price and thus making it affordable to our users.

### **Earn better ROI**

AR is modern-day technology which undergoes changes frequently, therefore an e-commerce or m-commerce retailer which provides such facilities will definitely earn much higher than the ones who aren’t using it.

### **Increasing brand presence and awareness**

AR is an amazing tool to enhance a company's brand awareness to wider audiences. Mobile apps with state-of-the-art AR features will help a brand provide unique experiences to users. The use of AR for retailer marketing strategies gives a lot of leverage to brands to find ingenious ways for interactions creating a tunnel for instant feedback.

## **Ease of trials/tryouts**

Waiting for your turn outside the trial rooms can be highly boring and time-consuming. Therefore, there are virtual mirrors where you can simply find out the size of the dresses you like and in a digital screen in front of you, you can see how that apparel is looking and fitting your body.

This is an amazing role of augmented reality in retail. You can also do this in online shopping too. Suppose while shopping for a pair of glasses, the app will scan your face to place the pair on your digital reflection. These types of gamification techniques play a huge role in driving retail sales.

## **How does a fashion recommender system create an impact on society ?**

Fashion recommender system is our main feature to attract users towards the available products on amazon.

Fashion recommender basically keeps our customers updated with the newly coming fashion in the modern world and market. It attracts users to try on clothes virtually without any waiting for launching the products into the market. Also, whenever a user is searching for any desired product then our recommender system will suggest apparel according to their interests which also helps us to know the interests of the user.



Fashion recommender system along with AR will bring a boost in the market as it will provide a virtual try on experience to our users and if the user finds interest in it ,then it will definitely bring a rise in the sales of amazon.

Also,the impact of social networks and the influence that fashion influencers have on the choices people make for shopping is undeniable. For instance, many people use Instagram to learn about fashion trends from top influencers, which helps them to buy similar or even exact outfits from the tagged brands in the post. When traced, customers' social behavior can be a very useful guide for online shopping websites, providing insights on the styles the customers are really interested in, and hence aiding the online shops in offering better recommendations and facilitating customers' quest for outfits.

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All ML stuff

