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An Introduction to Computer Vision

AND HOW IT WILL LEAD YOUR REAL ESTATE BUSINESS TO SUCCESS

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WHAT ARE WE TRYING TO ACHIEVE HERE?

John is a 35-year-old father who's recently welcomed a second child into his family. He and his wife are running out of space in their tiny apartment in San Francisco. So, they decided to look for a house outside the city, where they can peacefully raise their children and live a quieter life.

On a Sunday afternoon, John sits at his desk determined to search for his family's dream home. Sipping his coffee, he types 'contemporary house with natural light and garden San Francisco'. He wants his children to play outside and enjoy the sunlight.

After an hour of browsing through listings, John is convinced he'll never find the right place. Most websites weren't even real estate agencies, but interior design publications, and some property portals had low quality, disorganized, or few photos. Tired, he shuts his laptop down and sighs. He'll try again next Sunday.

The future of real estate

John's experience is not uncommon. Most real estate websites do not have tagged or optimized photographs of listings, despite its enormous advantages. Additionally, most professionals are hesitant to use technology, neglecting its significance to the industry.

Artificial intelligence (A.I.) has become an important topic, and there's no denying it. Disruption is a hot word in all real estate conferences and events, so why would you stay behind the trends? Why shy away from an opportunity that could only bring growth to your real estate business?

We put this guide together to explain how technology, specifically computer vision, can help you. Not only will you be simplifying the process of finding a home for people like John, but your chances of keeping him, and others, as a customer will increase considerably.

By integrating a computer vision service into your real estate platform, you will be able to:

- Detect sensitive or inappropriate material in your property photos.
- Rank higher on search engine results, increasing your number of visits.
- Enable voice search, hands-free online search and website optimization.
- Organize your images by category to enhance user experience.
- Look for visual similarities and recommend other listings to visitors.
- Detect logos and watermarks to gain higher profits and improve UX.
- Optimize your visual content, so visitors convert into leads easier.

2

FIRSTLY, WHAT IS COMPUTER VISION?

From daily recommendations of articles or images to placing a virtual mustache on an image of one's face, artificial intelligence is deeply embedded into our daily lives. But what does artificial intelligence have to do with computer vision? Well, everything.

Computer vision* is the science involved in providing computers "eyes" into the physical world, a way for them to "see" and understand information in images. It is a relative of Artificial intelligence (A.I.)*, a technological field that concerns itself with "making" computers intelligent. A.I. and computer vision complement each other in the constant evolution of technology.

An individual learns by interacting with their environment and engaging in repetitive tasks. Upon seeing a chair, we know what it is because it has 4 legs, a seat, and optionally, a backrest. Computers gain knowledge much like us humans, by learning through patterns. This is called machine learning. And what is one of the most essential parts of learning and understanding our environment? That's right: vision.

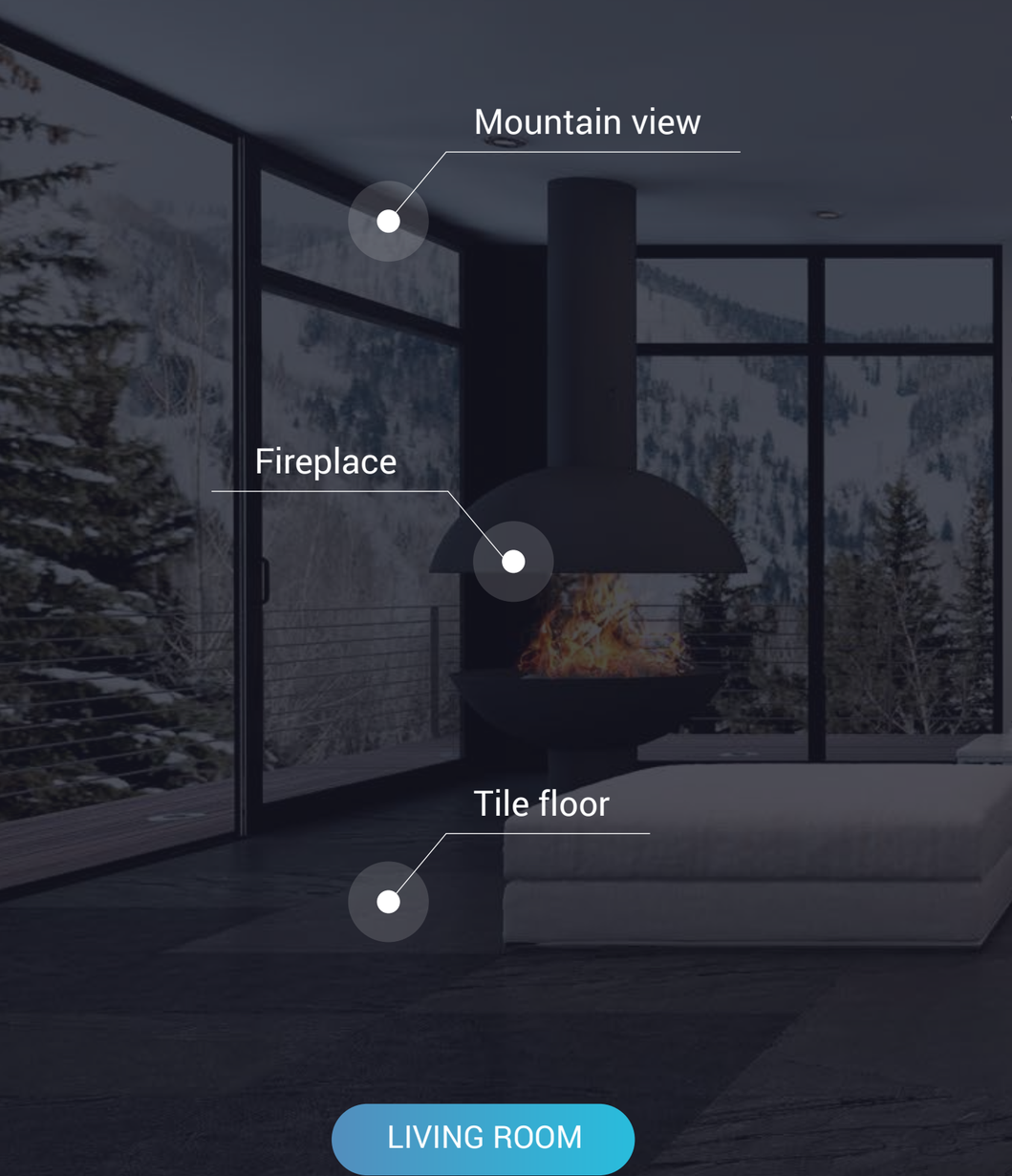
2. FIRSTLY, WHAT IS COMPUTER VISION?

Machine learning* gives computers the ability of learning to "see"- recognize and identify objects in images. The computer is being trained to distinguish objects in unusual settings, including driverless cars, facial recognition, medical diagnoses, and real estate, to name just a few. Then, it learns to recognize patterns. The machine can now see and understand traffic, recognize faces in the crowd, and diagnose illness.

Important: computer vision and machine learning are not the same thing. Computer vision is the “eyes”, while machine learning is the “brain”, a pool of algorithms and techniques training the computer.

Are you still with us? When computer vision and machine learning work together, a third technology comes into play: image recognition*. Image recognition is the final step - it detects, tags, and classifies objects that “the brain” teaches the “eyes” to see.

Remember: *Machine learning, the technological “brain”, and computer vision, the technological “eyes”, bring together image recognition, the solution able to identify and tag objects in images.*



What's the connection between computer vision and real estate?

Since image recognition finds and categorizes images and the concepts within them, individuals no longer have to go through thousands, even millions of images, and manually tag them.

Accordingly, the tech powered by computer vision and machine learning provides real estate portals the depth of specialized insight that, until now, has been the sole domain of real estate professionals with years of experience.

Powered by computer vision and machine learning, image recognition identifies, tags, and describes properties with language real estate professionals use every single day. It literally learns what contexts are meaningful to real estate websites.

Finally, image recognition is then able to distinguish the value of a cat in a photograph of a fireplace from, for instance, a “red brick in-built fireplace”. In this example, the cat is irrelevant to the real estate property context.

3

MODERATE TO INNOVATE

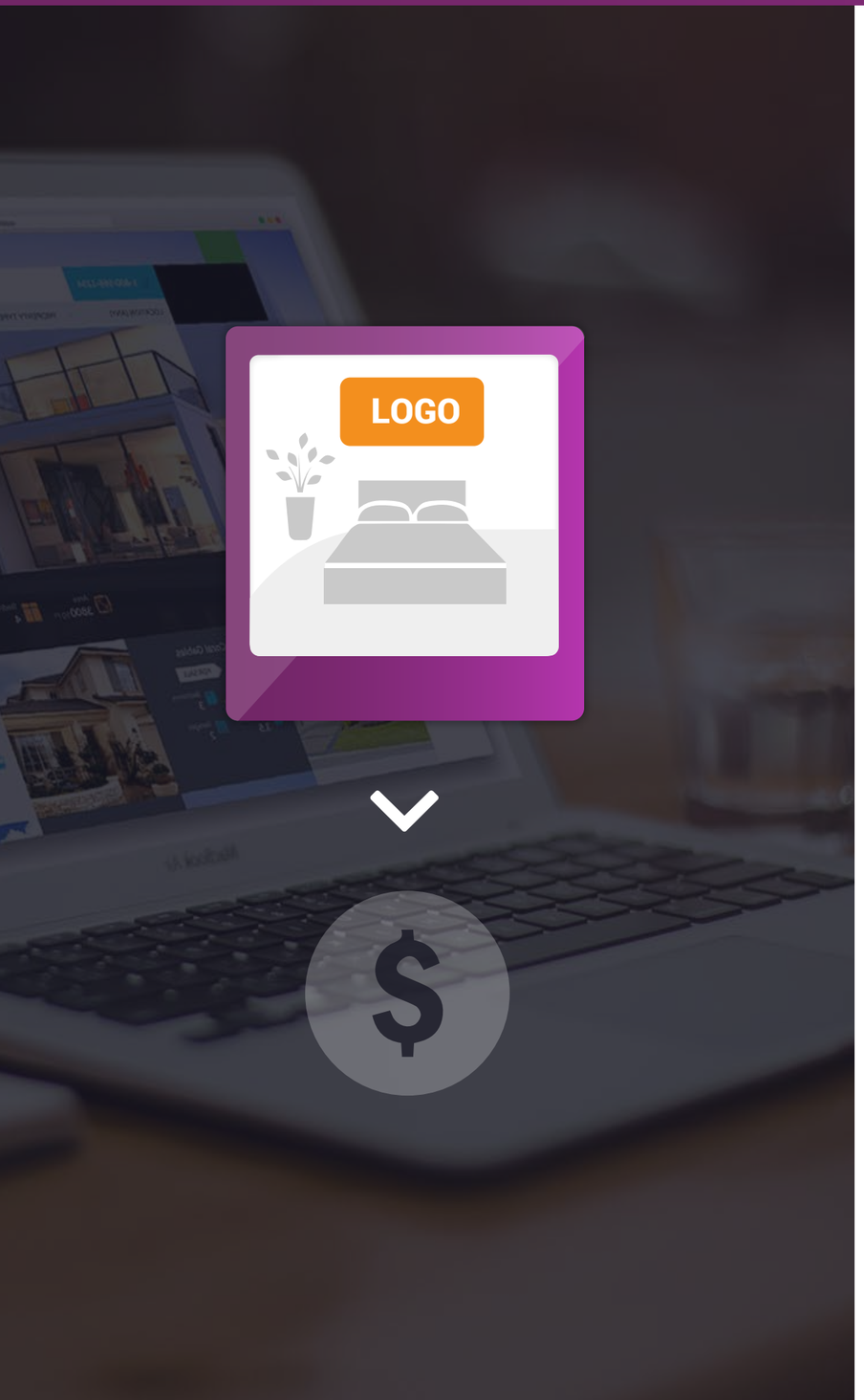
Content moderation* is at the heart of internet peace. Without it, your social media news feeds would be filled with horrific imagery, real estate listings would portray domestic scenes in one's apartment, and car theft would reach an all time high because of unprotected license plate numbers on the web. And this is just a small part of it.

Being a content moderator is a tough job. Imagine going through limitless content of violent, sexual, or other illegal types of behavior on a daily basis. Not only is it emotionally and psychologically draining to do so, but time consuming and risky. The manpower required to do this work can reach the level of thousands, like with Facebook's 7 500 content moderators.

However, due to the constant technological developments in A.I. and automation processes, computer vision can take over some of the emotionally and mentally draining work. Having your own machine learning solution and training it in-house would be counterproductive, as this requires analyzing and inputting such sensitive material for countless hours, increased costs and time inefficiency, as well as lower speed and accuracy levels.

This is why you should opt for a plug-n-play solution that's already been trained and developed to moderate and filter out sensitive and improper material. Whereas a human content moderator has to go through at least 2000 photos an hour, a computer vision solution can process over 100k images an hour without any limitations. That's quite the improvement, isn't it?

3. MODERATE TO INNOVATE



Aside from flagging inappropriate content, computer vision technology can also determine whether there are any logos or watermarks on pictures, especially from third parties. The human eye can get tired after looking at hundreds of images, especially when most of them have logos or unidentifiable watermarks on them. Therefore, identifying which photos need to be removed from your website is important to:

- Ensure your images comply with the industry standards.
- Declutter the visual.
- Keep leads on your website.
- Charge for third party logos and watermarks.
- Improve the overall aspect of your portal.

The last aspect to consider regarding content moderation is privacy. Often, real estate images contain irrelevant or risky details, such as cars or even individuals. No one wants to have their license plate numbers or facial features displayed on a real estate portal, where thousands of people have access to on a daily basis.

Therefore, it's essential to integrate a computer vision solution into your real estate business. By indicating which photos expose such private aspects, you can either remove them or blur the relevant parts. You will save significant time and money, while avoiding legal problems as well.

4

A SEARCH ENGINE OPTIMIZATION (SEO) JOURNEY

Nowadays, barely anyone is looking forward than the first page of their Google results. Additionally, Google is by far the most popular and most optimized search engine*. And Google wants your website to be incredibly optimized if you are to be in those Page 1 results (or as close as you can).

To reach that, you need a basic understanding of how search engines work. The web is an immense network of individual websites, documents, and images. As the web evolved, so did search engines.

Nowadays, search engines use these little "spiders", or "crawlers"*. They are automated robots, "crawling" through the infinite amount of information on the web, gathering data and scoring websites.

These crawlers are very important to your marketing strategy, as they:

- Read the text fields:
  - *to see how relevant an image is.*
  - *to understand how well the image and adjacent text are linked.*
- Collect and store the data in databases.
- Award different rankings to the crawled web pages, depending on how well optimized they are.

Based on this entire crawling process, you then see a list of results on your search query.

Computer Vision + SEO = Best Marketing Practice

How do you make the spider crawl and mark your business as an important leader on the web? The answer is quite obvious and easy: Search Engine Optimization*, otherwise known as SEO.

Google simply defines SEO as the 'process of making your site better for search engines'. You need to undergo a series of tasks and steps that will make your website more "visible" and clear to the crawler. When you make it understand, search engines are more likely to offer you preferential treatment against competitors.

Out of the several ways in which you can improve your SEO, computer vision and image recognition are essential when it comes to:

- Keywords.
- Voice search.
- Translating images into understandable concepts for the crawlers.

Keywords

Keywords* are the most important part of your SEO journey. What do people do when they search for something? They type (well, most of the time; we will see that things have changed a bit in 2018). What do they type? Words. Say again? KEYwords. We couldn't stress this enough, as they are the key to success (the puns are endless).

Remember the "crawlers" we talked about? Keywords are one of the main parts of your website that they look for.

You should optimize your website by linking all the relevant keywords to it. For example, if you have a real estate portal, you could use concepts varying from real estate to objects or features of a house; your opportunities are endless.

Remember: *Some keywords are harder to rank for. A lot of other companies and competitors also know about SEO and want to be the first in rankings.*

In order to avoid this situation, you need your keyword game to be smarter. For this, you can use long-tail keywords. If 'house' is the main keyword, a long-tail one would be: "contemporary house with garden San Francisco". The specificity will increase your chances of ranking higher, compared to a short generic keyword.

By properly categorizing and tagging your real estate images, computer vision can describe all images with real estate specific keywords, saving you time and effort in doing it yourself.

It's important to mention that since late 2017, the way search engines value keywords has changed. Nowadays, it's more important to relate your keywords to topic clusters, the new hot topic on SEO. They rely on your website and blog being linked together internally and externally. Simply put, you should link all your pages together for Google to see that one page relates to the other.

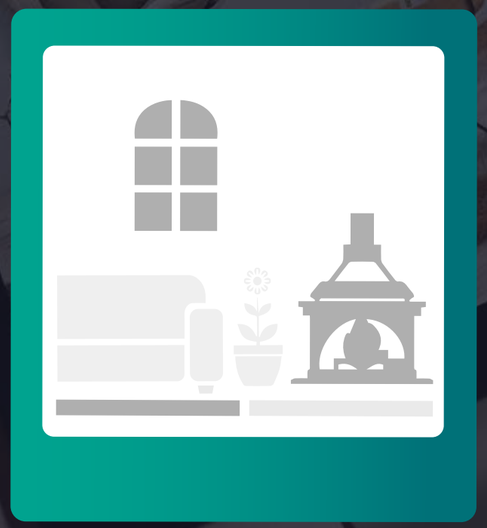


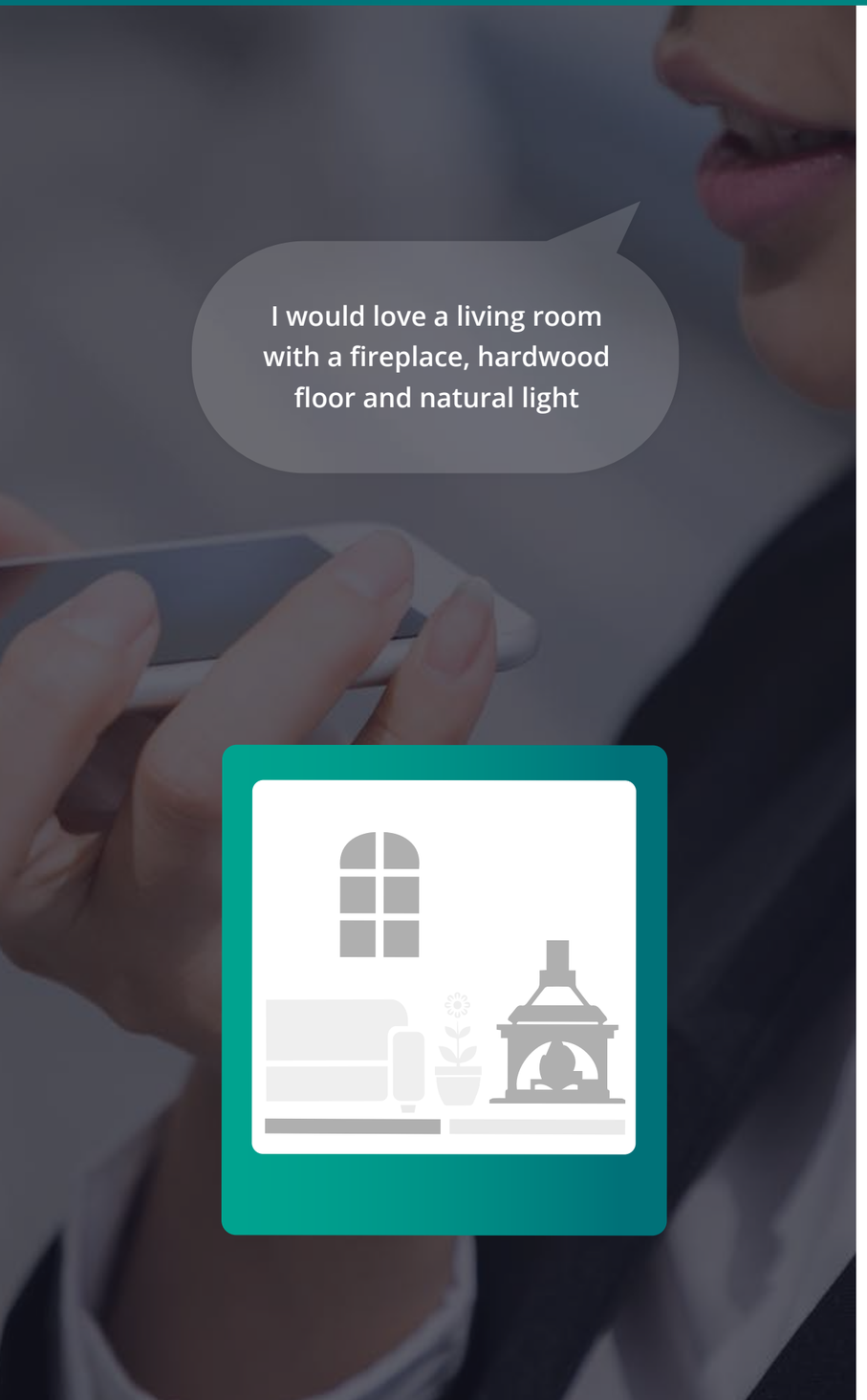
Image translation aka Alt-text

For search engines to understand your website completely, you need to input tags into the description behind images. Why is it important to put words behind photos? In the end, images are worth a thousand words, right? Not for the little spiders crawling the web non-stop. As smart as they are, they do not have the capacity to read images, as they are made of pixels, not letters or numbers.

This is why we need to make their job easier by filling in the description, or alt-text, behind these images.

For example, if your website has photos of a certain listing, the alt-text should include keywords that are related to the context of the image. If the visual portrays a living room with high ceiling and marble floor, then the description should read something like: “living room with high ceiling and marble floor”. The keywords will ultimately optimize your website to a level that spiders will love crawling it. Your images and content will be interrelated, improving the relevance of your website.

We’ve already mentioned that computer vision can tag objects, features, room types, and exterior styles. The final step is the automatic completion of the alt-text with the relevant tags. Implement - Activate - Done. Easy peasy. Who doesn’t love technology?



Voice Search

The final stop in our SEO journey is voice search*. In May 2016, Google CEO Sundar Pichai cited that 20% of all searches were voice. That percentage keeps increasing.

Compared to the classic 'type-your-query' search, where keywords and formulations are short and on point, voice search is more conversational and relies on processing natural language. It is an innovative way of interacting with technological devices and search engines, Google especially, value websites that enable it. It is faster, hands-free, and allows you to perform several tasks at the same time.

Moreover, voice search is an important catalyst in improving user experience and website optimization. Thanks to intelligent personal assistants (IPA)*, such as Amazon Alexa or Google Home, voice search is becoming simpler and more popular with each passing day. People are now one phrase away from finding the answers they need.

Remember the long-tail keywords we mentioned before? Revising these is essential in voice search. If John had decided to look for a home using voice search, his query would have been different. "Contemporary house with garden San Francisco" transforms into *"I would like a contemporary house with plenty of natural light, a garden, and a porch in San Francisco".*

Need we mention again that computer vision can help identify the major keywords you need to enable voice search? Better use your voice to ask your phone for "a computer vision solution for real estate".

5

AN UNFORGETTABLE USER EXPERIENCE (UX)

This chapter is not about you, us, or anyone else, for that matter. This chapter is about John - he is a visitor, a user, a consumer, a client - and how to best improve his online journey. The best way to do that is through improving your site's user experience (aka UX).

UX* refers to the process of designing products that are enjoyable and easy to use, as well as simple, intuitive, and delightful to interact with.

UX is Apple making you obsessed with your iPhone, thanks to its sleek design, accessibility, and state-of-the-art features. UX is Netflix giving you hundreds of entertainment recommendations and automatically playing the next episode of your favourite show.

What both Apple and Netflix have achieved is a way for you to enjoy their products. Nowadays, it's difficult to imagine a world without them, as they have set the mark high up on the ladder. Simple and visually appealing products are the new expectation when it comes to today's market.

Think of your real estate portal as a product (which it actually is). You probably dress professionally at the office and use certain language to talk to sellers or potential clients. Why not pay the same attention to your website?

A clean, visually pleasant website will not only give your visitors an enjoyable experience, but will also make them come back.

CV + UX = Best Chances of Visitors Returning

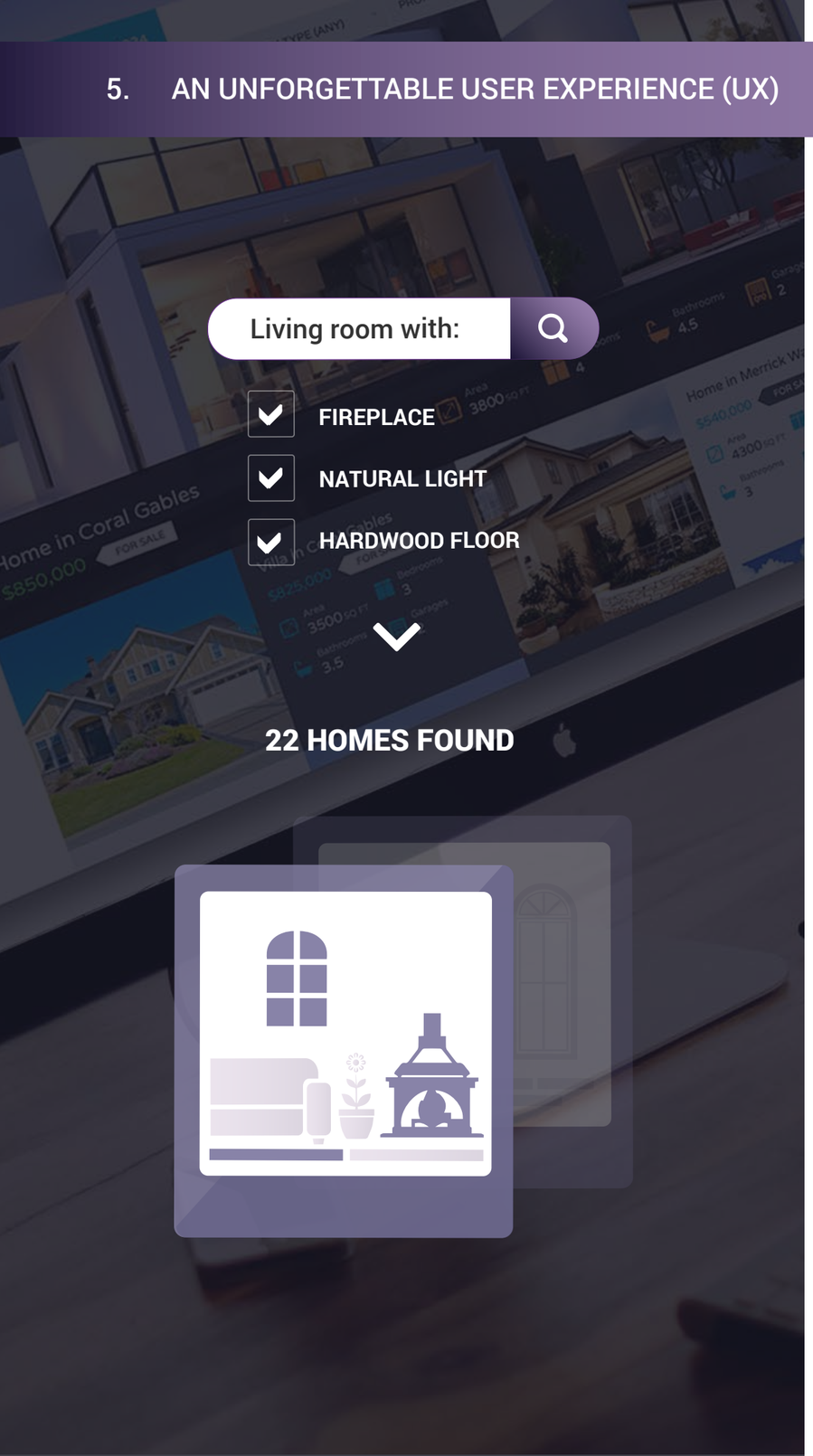
Organize

How many times did John stumble over listings where the images were disorganized and a picture of the bedroom was followed by one of the bathroom and then another one of the bedroom? To top that, the photos were bad quality and the objects undistinguishable. Putting all the bathroom or all the kitchen pictures together sounds like a basic thing, right? Yet, so many portals don't do it, because people don't have the time or resources to.

John, who is skimming through dozens of different listings, has to absorb and process hundreds of images. Since the flow of photographs keeps jumping from one room type to another, it's much harder for him to absorb all the information.

Computer vision will organize your photos according to room types and determine which images are too low-quality for public view.

For example, if a listing has 3 photos of the living room, 2 of each bedroom, and 3 of the kitchen and bathroom, the technology will order them properly. Your listings will have a clean, well-designed look, thanks to the proper assortment and high quality of the images.



Visualize

One of the reasons why John grew tired of searching was the lack of relevant listings, home comparisons, and thumbnails. He kept jumping from portal to portal, reaching no conclusion.

There are three ways through which computer vision can prevent this situation:

- Room by room comparison.
- Filtered thumbnails by desired room type.
- Better search experience for the visually impaired.

I. Room by room comparison

As John is researching the house of his dreams, he isn't just looking through photos, reading descriptions, and deciding on the spot. He is a knowledgeable consumer, so he collects information, organizes it, and compares his findings to see which house is best for him.

To convince John that your offer is the best, you should ease his decision making process. By integrating a computer vision solution in your business, visitors can select to view room by room comparisons straight on your website. Since John is interested in a large green garden, he can view and compare backyards or front lawns of different houses.

II. Filtering thumbnails by room type

For the comparison system to work seamlessly, your website requires accurate thumbnail categorization. If your portal displays an image of a toilet as a thumbnail for a house listing, chances are that John will have second thoughts about buying from you.

Additionally, without optimized thumbnails, room by room comparison would be impossible. But, thanks to computer vision and its accurate predictive powers, your website will have relevant high-quality thumbnails to accompany the description of a listing.

III. Improving the search experience for the visually impaired

If you're unaware of ADA (Americans with Disabilities Act), you need to look it up right now. It is a set of regulations put in motion to help people with disabilities in becoming more active and involved members of society. One aspect of ADA is making your website easy to navigate and understand for everyone.

With regards to individuals who are not able to see, having a computer vision solution is essential. It can "read" images and transpose them to text, i.e tagging an image with keywords. Afterwards, a text-to-speech software can read these keywords out. So, if a visually impaired person is searching for a new home, they can easily find out what your listings look like, thanks to these vibrant audio descriptions.

Remember: *Visitors spend more time on your website if they see organized, high-quality photographs and thumbnails, and room by room comparisons. Organize and optimize your images accordingly and John will become your client sooner than you think.*

6

THE MYSTERY OF CONVERSION RATE OPTIMIZATION (CRO)

John remains on your website thanks to the optimized photos and suitable thumbnails. However, he is still not entirely convinced. If only there was an easier way to convert cold leads into more qualified ones.

What's that? Conversion rate optimization (CRO)*? Why didn't you say this before?

CRO is a process through which the number of visitors who engage in a 'desired action' increases. Think of all the time, money, and effort you spend on bringing potential buyers to your website and how frustrating it is when those buyers browse for a few seconds and then bounce.

There are three main steps to optimize your content and quickly capture interest:

- Making sure that the quality of your visual content is high.
- Always trying to display the most interesting thumbnail for a buyer.
- Quickly recommending listings, similar to the ones your visitor is interested in.

Remember: *The key for these steps to succeed is to have properly tagged images!*

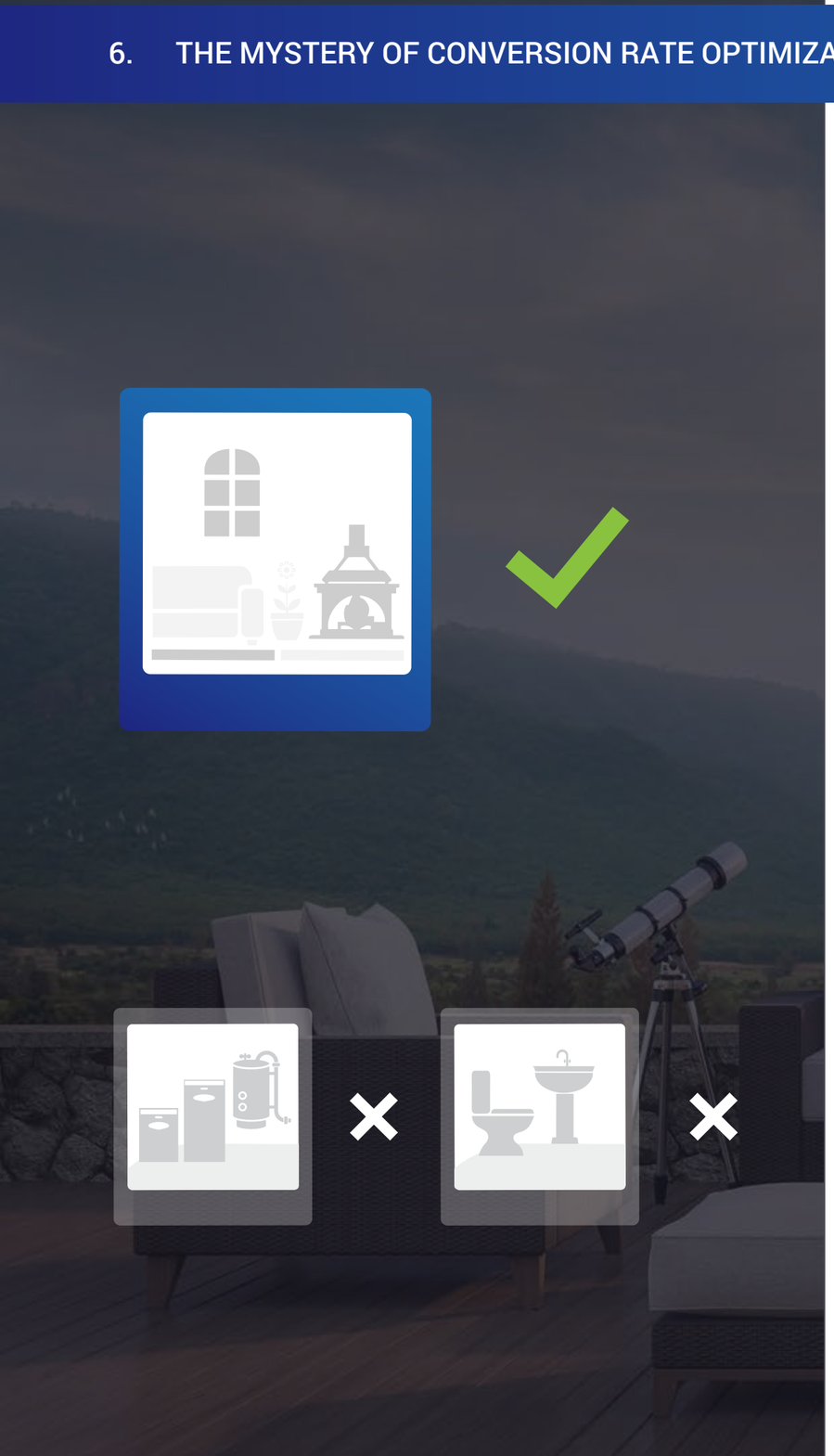
1. High visual content

Nowadays, images and videos have reshaped the way we consume information online. Having sharp, clean, and uncluttered images increases the visual appeal of your content and people's attachment to it.

Your real estate website needs to have professionally looking photos, ideally home staged. Everyone likes a photograph of a well lit, fresh room, one where they could imagine themselves live. If you have an image of a dark living room with paint falling off the walls, no one will even dare to look twice.

As mentioned in chapter 3, you should avoid having big logos or watermarks on your photos because they add clutter. We couldn't stress enough how important it is to have visually appealing photos, without the name of a company written in big distracting font letters.

A specialized real estate solution will determine which images are of high quality and appropriate for your website. Additionally, it will automatically detect and tag logos and watermarks, so you can take immediate action by either removing the images or charging third parties for them.



2. The perfect thumbnail

Always do your best to show the most relevant thumbnail when displaying a list of properties, also called “The Hero Shot”. This could be something as simple as making sure you never show an irrelevant thumbnail, like the picture of a utilities room.

A more advanced approach is testing what type of room converts better as a hero shot, otherwise known as A/B testing*. This experiment involves comparing two versions of a variant you’re testing; in our case, the hero shot.

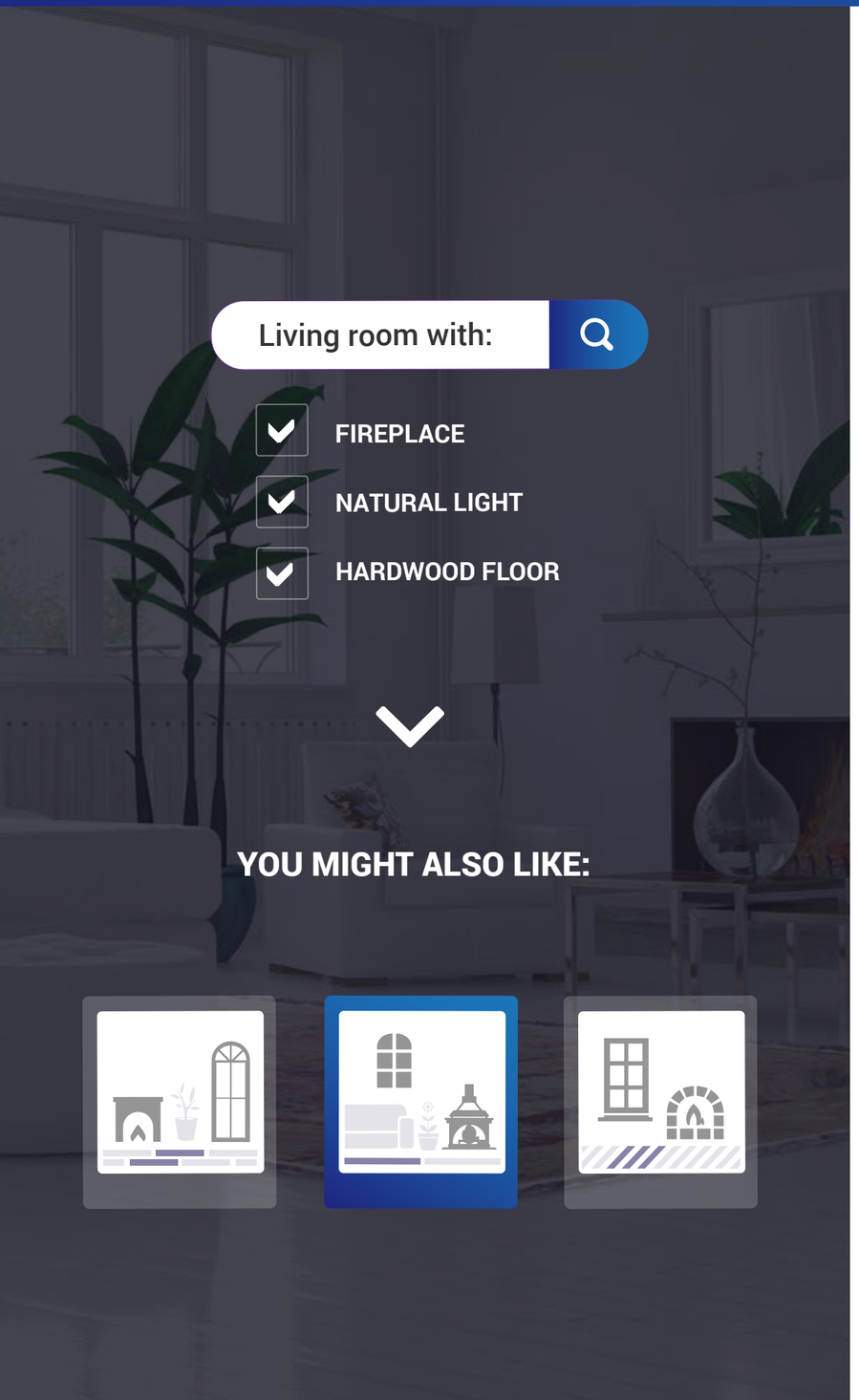
For example, you have a timeframe of one month: 2 weeks you only use images of the house exterior as a thumbnail (this is your A test) and for the following 2 weeks you only use images of the kitchen (this is your B test).

When the month finishes, you collect the results, analyze, and compare them.

The results will show which test led to more click-throughs: ‘A or B’. You choose the winner and then do another A/B test with the winner vs another contender. As you continue doing this you’ll see a steady increase in click-throughs and in conversion rates percentages.

Remember: *You can become better at CRO only if each image is properly tagged.*

A more advanced way to optimize the hero shot is to curate the thumbnail to the buyer’s personal preferences. John loves to cook, so you should frontload images of kitchens. He also loves gardening - that’s right, show him some beautiful backyards. And so on. You’d be surprised how accessible this type of profile information is nowadays.



3. Recommended listings

John has spent some time on your website browsing through your listings. But, he still hasn't found "the house" because he had to go through all properties and check whether they have what he's been looking for.

To try and solve this, think of Netflix. No, we're not asking you to watch a movie, but to explore their recommendation algorithms.

Netflix almost pioneered this concept of a recommendation engine. First thing on opening their website, you see top suggestions based on your past interaction with the platform, like watching Sherlock Holmes and House of Cards.

Your real estate portal can easily benefit from this sort of process. John is looking at listings that have plenty of natural light. Thanks to the computer vision solution you've started using, your website looks into other listings that have large windows for natural light to come in.

Last, John will see images of those listings and he'll be much happier. He has saved significant time and energy just by clicking on all the recommendations he's seen.

Essentially, you're no longer letting him just browse through different listings; you're guiding him through a path of listings that are most interesting to his buying needs. Therefore, you increase the odds of John converting as a lead and contacting you.

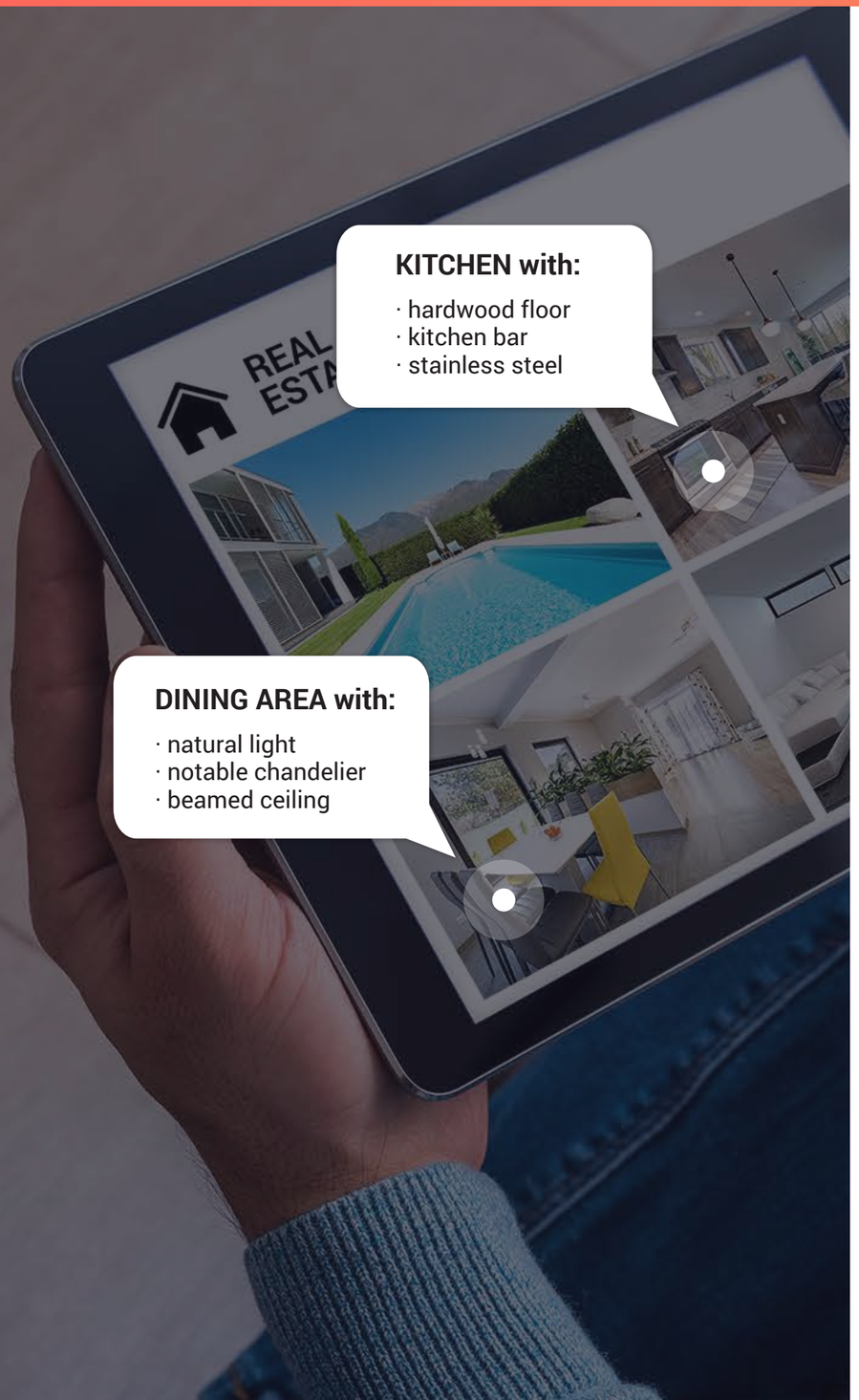
7

A NEW CHAPTER

It’s Sunday afternoon again and John is browsing the internet for a home. He feels quite lucky this time because he found a website with incredible listings: your website.

He stumbled upon it in the first few pages on Google and couldn’t believe he overlooked it the week before. It has a clean, organized look and the house images are high-definition and clear, with no logos or watermarks obstructing different parts of the property. The photo slideshow is nicely arranged according to room types and features. There’s also no inappropriate objects or license plate numbers on the car in the garage.

To top that, he’s just seen an impressive house in the “recommended for you” tab. After due consideration, he looks for your contact details and plans to call you tomorrow. This might be it.

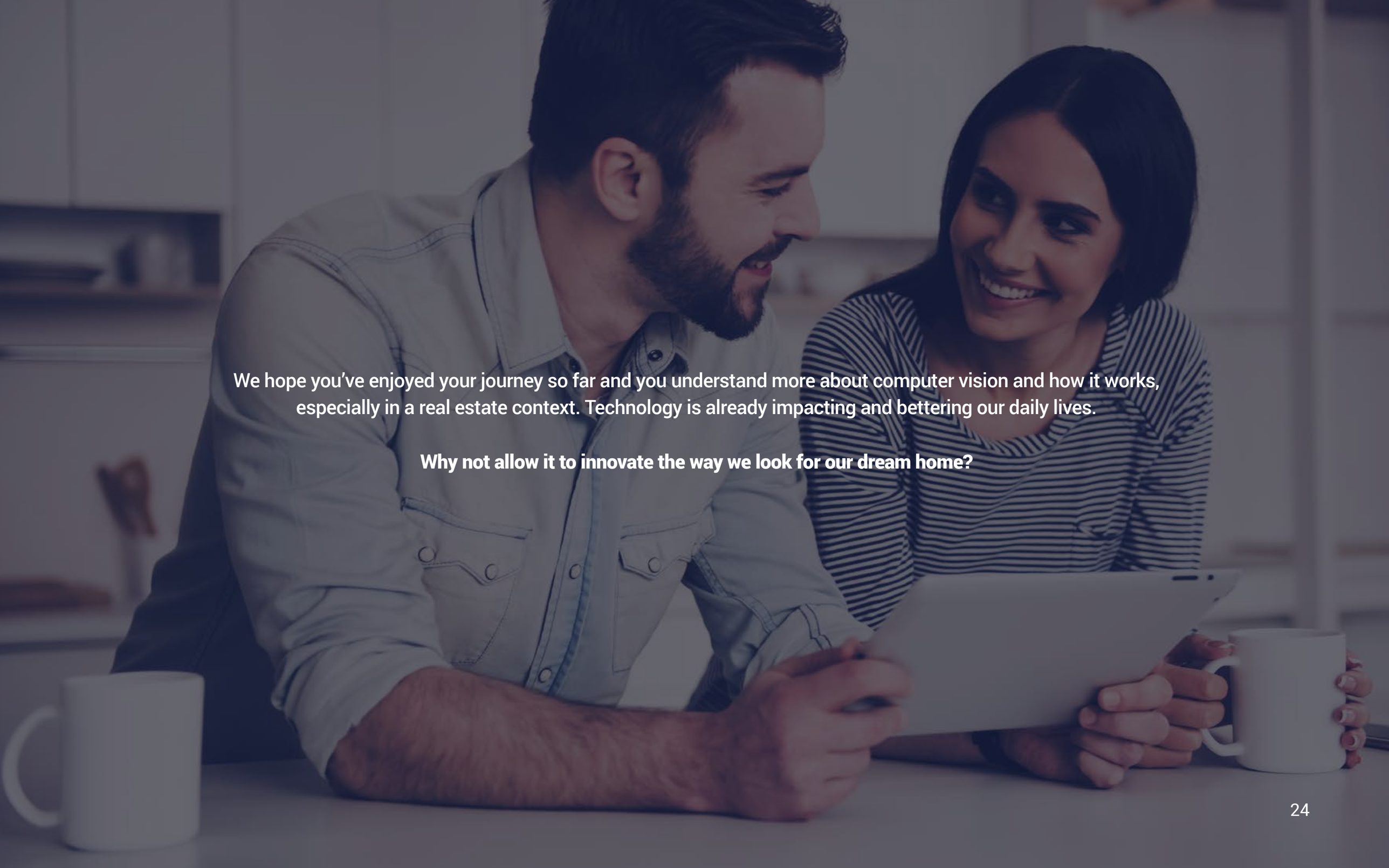


Having a computer vision solution will provide you with the necessary tags to organize and make the most out of your real estate images. Firstly, you will get:

- The keywords necessary to rank higher on search engines:
  - *through the description behind images (alt-text).*
  - *through enabling voice search.*

Then, computer vision will improve your buyer's user experience. It will:

- Flag inappropriate and sensitive content in images.
- Organize your photos based on room types and features.
- Show relevant and optimized thumbnails.
- Ensure that your photos are visually appealing and of high-quality.
- Enable your website to recommend similar listings for your buyer.



We hope you've enjoyed your journey so far and you understand more about computer vision and how it works, especially in a real estate context. Technology is already impacting and bettering our daily lives.

Why not allow it to innovate the way we look for our dream home?

*INDEX OF WORDS AND DEFINITIONS

A/B TESTING = *when you compare two versions of a web page to see which one performs better.*

ARTIFICIAL INTELLIGENCE = *the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.*

COMPUTER VISION = *field of robotics in which programs attempt to identify objects represented in digitized images provided by video cameras, thus enabling robots to "see."*

CONTENT MODERATION = *Content moderation is the organized practice of screening user-generated content posted to Internet sites, social media and other online outlets to determine the appropriateness of the content for a given site, locality, or jurisdiction.*

CONVERSION RATE OPTIMIZATION = *the art and science of getting people to act once they arrive on your website.*

CRAWLER (OR SPIDER) = *program or automated script which browses the World Wide Web in a methodical, automated manner.*

IMAGE RECOGNITION = *the process of identifying and detecting an object or a feature in a digital image or video.*

INTELLIGENT PERSONAL ASSISTANTS (IPA) = *software that has been designed to assist people with basic tasks, usually providing information using natural language.*

KEYWORDS = *particular word or phrase that describes the contents of a Web page.*

MACHINE LEARNING = *discipline concerned with the implementation of computer software that can learn autonomously.*

SEARCH ENGINE = *service that allows Internet users to search for content via the World Wide Web (WWW).*

SEARCH ENGINE OPTIMIZATION (SEO) = *set of methods used to increase traffic to a website by increasing its search engine page rank.*

USER EXPERIENCE (UX) = *system that facilitates and enables the development of technologies centered on ease of use and accessibility for a human user.*

VOICE SEARCH = *speech recognition technology that allows a user to perform a search via a voice command.*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