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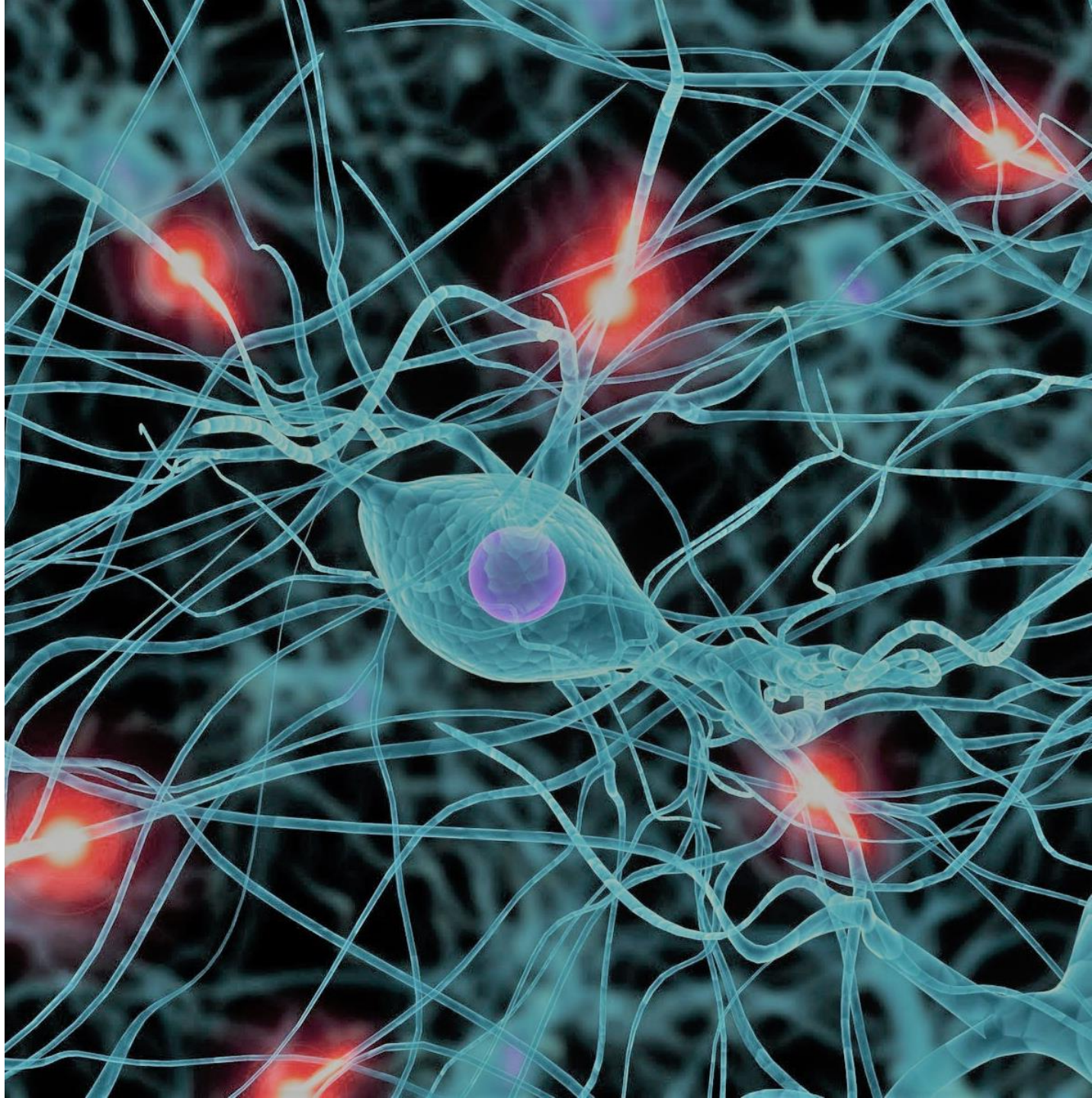
GIOIN
Gasperini Italian Open Innovation Network

LE NUOVE FRONTIERE DALL'AI ALL'AR E L'IMPATTO SULLA QUOTIDIANITÀ

Deloitte Analytics &
Information Management

Torino, 26/03/2018



AUGMENTED REALITY FUNDAMENTALS

ARTIFICIAL INTELLIGENCE

It is **man's attempt** to design and build **an artificial computer** capable of thinking and acting **like a human being**.

MACHINE LEARNING

It represents a **set of methods** developed over the last few decades, which share the **ability to learn from a set of data** and make **predictions**.

DEEP LEARNING

It is a particular field of research, **belonging to Machine Learning**, which fully exploits the concept of **Artificial Neural Networks** in order to process information.

1950s *1960s* *1970s* *1980s* *1990s* *2000s* *2010s*

Deep Learning Focus

Theoretical results suggest that in order to replicate complicated functions that can represent high-level abstractions (e.g. in vision, language, and other AI-level tasks), deep architectures become mandatory. These are composed of multiple levels of non-linear operations, such as in neural nets with many hidden layers or in complicated propositional formulae that leverage a big set of sub-formulae. Searching the parameter space of deep architectures is a difficult task, but learning algorithms such as those for Deep Belief Networks have recently been proposed to tackle this problem with notable success.

EXAMPLES OF DEEP LEARNING

Natural Language Processing

It is the process of automatic processing of information written or spoken in a natural language.

Computer Vision

It is the set of processes that allow a machine to observe and then process the information included in an image or video, giving it a definite "recognition" capability.

Speech Recognition

It is the process through a machine recognizes and then processes human oral language.

WHAT IS AUGMENTED REALITY?

AUGMENTED REALITY

It is **the overlay** of computer generated digital contents to real-world environment, altering it.

The overlaid information can be **constructive**, enriching the natural environment, **or destructive**, masking one or more objects.

It's different from **Virtual Reality**, which completely replaces the real world with a virtual one

It's **real-time**

Deloitte predicts that over a billion smartphones users will create augmented reality (AR) content at least in 2018

DEVICE PREFERENCE FOR VARIOUS ACTIVITIES

	Total	Male	Female	18-24	25-34	35-44	45-54	55-64	65+
Make online purchases	Laptop	Laptop	Laptop	Laptop	Laptop	Laptop	Laptop	Laptop	Desktop
Online searches	Laptop	Laptop	Laptop	Mobile phone	Mobile phone	Laptop	Laptop	Laptop	Desktop
Watch short videos	Laptop	Laptop	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Laptop	Laptop	Desktop
Check bank balances	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Laptop	Laptop	Desktop
Video calls	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Laptop	Laptop
Check social networks	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Laptop	Tablet
Read the news	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Laptop	Tablet
Play games	Mobile phone	Console	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Tablet	Tablet
Voice calls (VoIP)	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone
Take photos	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone
Record videos	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone	Mobile phone
Stream films and/or TV series	Television	Television	Television	Television	Television	Television	Television	Television	Television
Watch live TV	Television	Television	Television	Television	Television	Television	Television	Television	Television

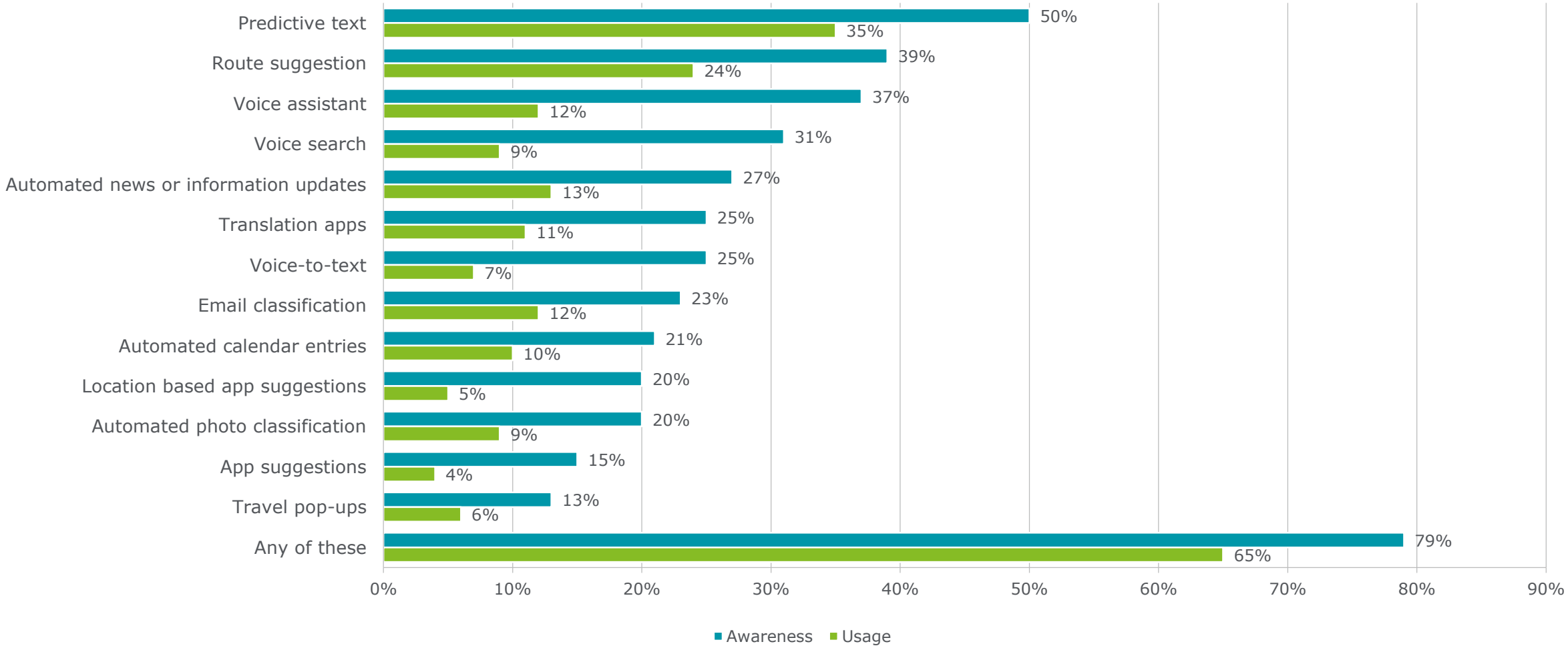
Mobile phone
Tablet
Desktop
Console
Laptop
Television

Weighted base: smartphone owners in 16 developed markets (22.929 respondents). The figure is the average of 16 countries in our study, namely Australia, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Spain, Sweden, the UK and the USA.

Source: Deloitte's Global Mobile Consumer Survey, developed countries, May-July 2017

AI AND SMARTPHONES

Awareness and usage of application featuring ML (developed markets)



Weighted base: smartphone owners in 16 developed markets (24.563 respondents). The figure is the average of 16 countries in our study, namely Australia, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Luxembourg, the Nederland's, Norway, Spain, Sweden, the UK and the USA.

Source: Deloitte's Global Mobile Consumer Survey, developed countries, May-July 2017

SMARTPHONE DEVELOPMENT WILL STRENGTHEN AUGMENTED REALITY ADOPTION

1. **Over the past three years, AR has become an increasing popular smartphone application, often for entertainment applications**
2. **Mobile phones will be increasingly equipped with dedicated OS AR framework, Visual Inertial Odometer systems (VIOs)**
3. **Dedicated frameworks within standard OS, lowers the cost of developing AR apps and this should increase the supply of apps embedding this kind of feature**
4. **HW manufacturer have improved the precision of their latest chips, allowing camera and inertial measurement unit (IMU) to work closely together**
5. **Algorithms are also critical to creating and displaying compelling AR content**

USE CASE OVERVIEW

The app enables people to **take photos** with mobile devices, **recognize** the garment, **identify** similar items available and related product information (characteristics)

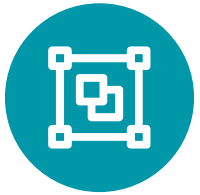
Eligible for **Fashion & Luxury Market**, since it's difficult to describe a "style" just with words

Modern shoppers **get inspired** on Instagram, Pinterest and other social networks, want to **shop** specific **styles**, and require **personalized recommendations** and services, without wasting time

Now. We live in digital revolution in which our **communication** is based on **images**. **Search** is going to be about **pictures** instead of keywords (65% of the population consists of visual learners)

It is a trusted app to choose the best outfit with **custom searches** based on **product, price, retailer, category** and more**...**

MANAGED DATA



STOCK KEEPING UNIT (SKU)

Detailed **characteristics** of the product such as model, collection, color, material, etc.

STYLE & OUTFITS

Suggestions of items belonging to the **same category** or products **frequently bought together**

INFLUENCERS & TESTIMONIALS

Related **advertisement** material and video from **fashion shows, testimonials and influencers**

TRENDS ON SOCIAL MEDIA

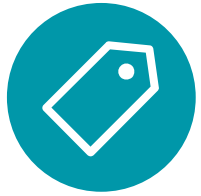
Trends and **reviews** of the product on **social media** such as Instagram, Facebook, Pinterest, etc.

STORES

Price and **stores** where the product is sold (both online and offline)

CUSTOMER DATA

Demographic data and **purchasing behavior** of the customer (e.g. average spending, preferred product categories, etc.)



ACTIVE PROMOTIONS

Information on **ongoing promotions** and **special offers** related to a specific product

INVENTORY

Information on the **product availability** of physical and online shops

HOW IT ENRICHES THE OVERALL CUSTOMER EXPERIENCE

EXAMPLE OF LESSON LEARNED

INCORRECT CLASSIFICATION

Image classified as BOOTS

Image classified as SHOES

Image classified as SANDALS

The noise introduced by the presence of the background and the additional details of the environment reduce the classifier performances.

EXAMPLE OF LESSON LEARNED

APPROACH

Train model

Reduce noise

TECHNICAL SOLUTION

Image Manipulation Sub-Module

This facility is part of the Engine module included in the Web Service of our system. It is in charge of pre-processing all the images received through the Rest infrastructure before sending them to the Classifier.

Image Manipulation Steps:

- *Remove Background noise*
- *Improve Color and Contrast*
- *Resize image to standard dimension*

Tech: Python, the Pillow package

Dataset enrichment

This task has been included to improve the quality of the training set for the neural network.
It manipulates the original images and creates alternative views of them to be included in the training set.

Training Set enrichment steps:

- *Image.rotate(rotation degrees)*
- *Image.convert(mode=mode)*
- *Image.thumbnail(dimension)*
- *Image.filter(ImageFilter.mode)*

Tech: Python, the Pillow package

The pre-processing performed by the Image Manipulation Sub-Module and the Dataset enrichment allows for an increase of the **confidence level** also in the case of images in which the footwear is not the only subject.

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