

Bridging the gap between the academical research and the surveillance industry

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1. Types of companies

- Companies that provide **off the shelf products**
 - Products that we can buy packaged in a box, taken directly from the “shelf” of a shop
 - HW or SW products
 - Available for the general public
 - Easy to configure
 - NOT customized
- Companies that design and develop **customized solutions**.
 - Customized products or projects to specific problems.
 - Sometimes these solutions involve having more than one existing product or developing something specific
 - Each installation has its particular characteristics that should be taken into account
 - These products require an engineer from the company to assist the clients



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2. Customer interviews

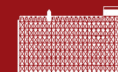
- A **customer interview** is a interview used to understand customer's needs.
- It is a key mechanism for capturing what clients **really** need
- Just when you have interviewed several customers, you can take a decision about which **features** are **important** to be included in your product.
- How many interviews? The more the merrier!

Learning to interview clients is a very important skill that should be developed.



Comparison between research and industry

Academic research	Company
The goal is to generate knowledge	The goal is to guarantee the success of a product or service
The team is composed of a group of researchers	The team is a multidisciplinary group integrated in different departments: R&D, development, sales, manufacturing, ...
The target of study can be any scientific phenomenon	The product is aligned with a marketing strategy
The product does not have marketing purposes. If the product is offered to the consumers the objective is mainly to obtain feedback	The product should be launched into the market and should be profitable
User satisfaction is not the main purpose of the research	The user is involved in all the phases of the development. The user satisfaction is related with the success of the product



Carol's case

A hypothetical friend of mine, Carol, is working on a video analysis solution to find the **most common trajectories of people inside a shop**.



She is a **researcher** (but she may also be an employee of a company in the **surveillance** industry)

She tells me that she has developed an algorithm that works very well to extract trajectories of people in a shop, but after showing the software to a couple of shop owners she knows, they seem to be interested, but she does not know what to do next and feels disappointed.



WHY STARTUPS FAIL

Because they create a **product that nobody wants**

or

Because they **lack clients.**



THE LEAN STARTUP

My advice for Carol would be to use the **Lean Startup** methodology to develop new products:

*Lean Startup is a methodology used to develop **new products** (both if you are a startup or a company) which objective is to **speed up** the process of having a product on the market and to develop a **product that customers love**.*

To do this, it focuses mainly on **validating with our customers** the assumptions we make to develop the product



THE LEAN STARTUP

The steps to apply the Lean Startup methodology are the following:

1. Define the **vision** of the product
2. Write down the **hypotheses** made to develop the product
3. The **Build-Measure-Learn** cycle





CAROL'S VISION

The first step is to define what our product is going to do. This is called the **vision**

Carol should define the vision of her product:



*“A software to find the most common **trajectories** of clients inside a shop...”*



CAROL'S HYPOTHESES

The second step is to write down the **hypotheses** we make to develop the product

*"I **believe** that knowing the trajectories of users inside a shop is a valuable information for shop owners **because** with this information they will be able to take proper actions to place products"*



*"I **believe** that the trajectories should be computed in the intersections of corridors (not for all the shop) **because** this is the most useful area to extract information on trajectories"*

*"I **believe** that the software will be able to use the existing surveillance cameras **because** it is cheaper to reuse hardware"*



BUILD-MEASURE-LEARN

Carol has written down her hypotheses and should then choose the most important and **highest priority** ones. They are known as **IDEAS**

With those ideas she will be able to develop a **Minimum Viable Product (MVP)**, a working version of her product that a customer would be willing to buy. Basically the MVP is our **CODE**

***NOTE:** An MVP should be functional from the very beginning, even though it does not include all of the functionality of the finalized product. We learn from customers between iterations and keep them happy and satisfied with our results, that they can try and even buy*



BUILD-MEASURE-LEARN

HOW TO BUILD A MINIMUM VIABLE PRODUCT

NOT LIKE THIS

1 2 3 4

LIKE THIS

1 2 3 4 5

image by blog.fastmonkeys.com original idea: spotify product team



BUILD-MEASURE-LEARN

The next phase is **validating our hypotheses** with customers/users by presenting our **CODE** and **interviewing** them.

We can start to determine what our customers like and do not like from our product.

Why do you need to know the most common trajectories inside a shop? What would you use this information for?



In which areas of your shop do you want to obtain this information?

Do you think that it will be possible to use current surveillance cameras for this purposes?



BUILD-MEASURE-LEARN

With the results of the validation we will be able to extract some **DATA** to analyze

Why do you need to know the most common trajectories inside a shop? What would you use this information for?

Shop owners want to know the most common trajectories of clients to determine the best areas to place products with higher profit margins

In which areas of your shop do you want to obtain this information?

They would like to cover all the surface of the shop

Do you think that it will be possible to use current surveillance cameras for this purposes?

Definitely not, those cameras are not always accessible and they have occlusions





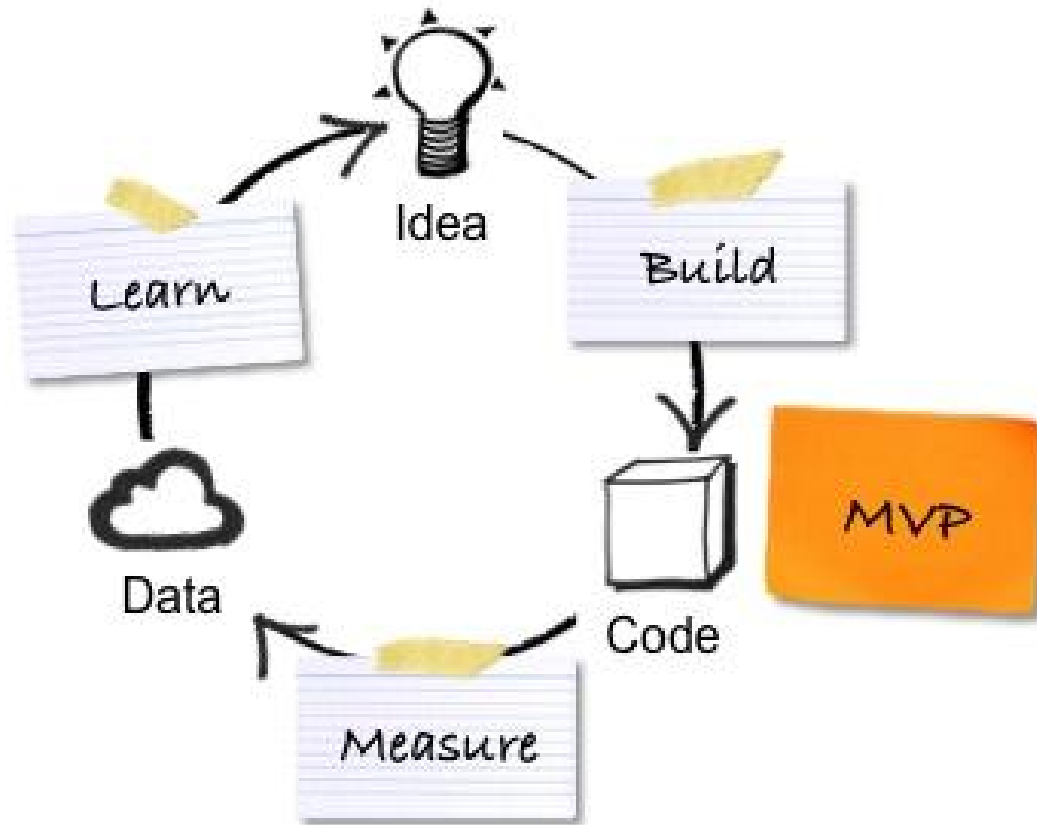
BUILD-MEASURE-LEARN

In the **learn** phase we are able to determine the next features we must include in our product.

We will analyze the **DATA** we have extracted from our customer interviews and convert this data into new **IDEAS** to build a refined version of the MVP, choosing the highest priority ones.



BUILD-MEASURE-LEARN





BUILD-MEASURE-LEARN

PIVOT

If we realize that customers are not interested in the product we have presented to them, but we discover that they need something different we need to **pivot**

In a customer interview, we should be prepared to detect that **users do not need or want our product**, but they need something different. Then we have to **change our product** and develop what our customer really needs



BUILD-MEASURE-LEARN

Imagine that Carol, in one iteration of her build-measure-learn cycle, is trying to validate her ideas and realizes that what customers really need is not to know the trajectories of people, but they want to know whether a **marketing campaign is working** or not

She should be capable of detecting that this is a **different product**, that may have some commonalities with the previous one, but the most important thing is to **pivot** to put her efforts in the product her customers will love



THE LEAN STARTUP

Some tips for **researchers**:

- The code of the research (prototypes, algorithms) may be easily converted into an **MVP** to show to customers.
- Then you should be prepared and write down the **hypotheses** you made to develop your product
- Then you should be ready to learn from customers, **validating** your ideas with as many customers as you can
- ...



THE LEAN STARTUP

If you are responsible of a development team at a **company** you may already be familiar with this methodology (if you are not I recommend you to do it)

- Take some time to train your (new) employees to help them understand the process to develop new products.
- Remember that people starting a new job is predisposed to learn a lot, and giving them the right tools and training will result in a great benefit for the company.



OTHER METHODOLOGIES



BRAINSTORMING



BUSINESS MODEL CANVAS

VALUE PROPOSITION



CHALLENGES IN THE SURVEILLANCE INDUSTRY



Universidad
Europea

LAUREATE INTERNATIONAL UNIVERSITIES



Universidade
Europeia

LAUREATE INTERNATIONAL UNIVERSITIES



CHALLENGES IN THE SURVEILLANCE INDUSTRY

I. It is very difficult to develop a generic video analysis product

It's only possible to develop something generic if it is very simple, like a video recorder or a motion detection algorithm.

Constraints of off-the-shelf products:

- a. Need support from an engineer to do the fine adjustment
- b. The configuration of parameters needs training
- c. Lack of design, with the presence of unused (complex) features

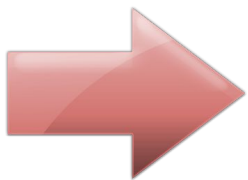


CHALLENGES IN THE SURVEILLANCE INDUSTRY

I. It is very difficult to develop a generic video analysis product

The volume of video generated by a camera is an example of **big data**. It is not viable to have one person annotating events from the camera 24/7.

With **deep learning** techniques it will be possible to extract information automatically, without any user intervention



It is necessary to migrate big data applications and deep learning techniques to the market



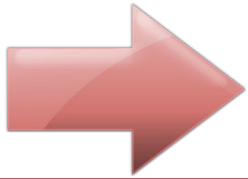
CHALLENGES IN THE SURVEILLANCE INDUSTRY

II. Updating a product with a new version of an algorithm is a hard task

The **improvement of the detection rate of an algorithm** in the research environment deserves a publication

Inside a company this algorithm will not probably replace its previous existing version in a product, because it implies:

- Validating the algorithm against validation databases
- Changes in the user interface and in the configuration
- Testing
- Upgrade existing equipments



Unless the new version of the algorithm proves to be much better in a real environment it will not be used in real products



CHALLENGES IN THE SURVEILLANCE INDUSTRY

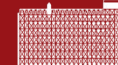
III. Research databases represent a small percentage of what happens in a real environment

There are several research databases that we can use to prove the performance of our algorithms.

They focus on some problems that have been studied for a long time (**intrusion, recognition, people's behavior...**).

The number of cases that those databases cover may seem big, however it represents a small percentage of what really happens when you have your surveillance camera working in a real environment

EXAMPLES: Presence of animals, insects, moving grass, dirty cameras, video artifacts...

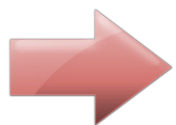


CHALLENGES IN THE SURVEILLANCE INDUSTRY

III. Research databases represent a small percentage of what happens in a real environment

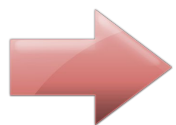
When there are no research databases available, it is necessary to generate our own database. We can do this in a two scenarios:

- **Laboratory:** when it is not possible to have a real installation we **simulate data** in a laboratory



Be prepared to deal with unexpected situations and problems in the real installation

- **Real environment:** the best option is to have a **pilot** as soon as possible



Plan how we are going to extract the **ground truth** of the data, to avoid having lots of useless data

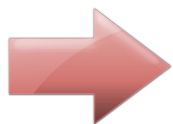


CHALLENGES IN THE SURVEILLANCE INDUSTRY

IV. Difficulty to integrate

Sometimes our algorithms are difficult to integrate due to hardware limitation, for instance:

- The algorithm is too heavy for the processor where it should be embedded
- Limited memory
- Fixed-point processors that do not allow floating point operations
- Impossible to cross-compile certain libraries
- ...



Be ready to face this sort of situations



CHALLENGES IN THE SURVEILLANCE INDUSTRY

V. Impact of the errors

- **False alarm ratio:** keep the false alarm ratio to the minimum.
If a surveillance system generates a lot of false alarms, the security personnel will not attend the system
- The **error rate** affects differently depending on the **type of application**.
Example: We have a 98% of success rate
 - For a people counter in the entrance of a shop is a very good rate
 - For a theft detection system it implies that 2% of times we will bother a non guilty client, and this is not acceptable



CHALLENGES IN THE SURVEILLANCE INDUSTRY

VI. Limitations of the computer vision techniques

In certain situations the computer vision techniques may not be the best solution to a problem. Examples:

- **Detection of abandoned objects:** it is very difficult to provide a commercial solution to detect abandoned objects. The algorithms usually generate a lot of false alarms in a real environment. There are also blind areas that we cannot cover with our systems
- **Suspicious people detection:** difficult even for a trained person.
- **Small targets:** it is very difficult to detect/classify an object that has a small pixel size
- **Camouflage:** if people are wearing camouflage it will be very difficult to detect them



CONCLUSIONS

- It is very important to have continuous contact with customers/users
- Knowing the main differences between research and industry can help us to bridge the gap between them
 - Knowing the techniques that companies use to create new products is a competitive advantage for both researchers and employees of a company
- Some of the challenges in the surveillance industry can be better faced if researchers and companies work together

