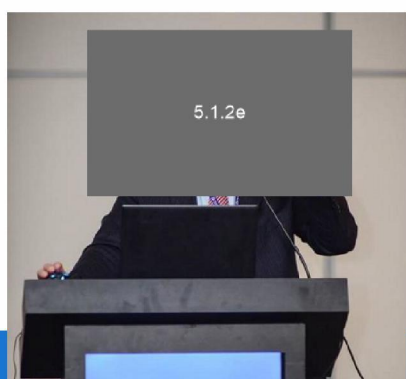
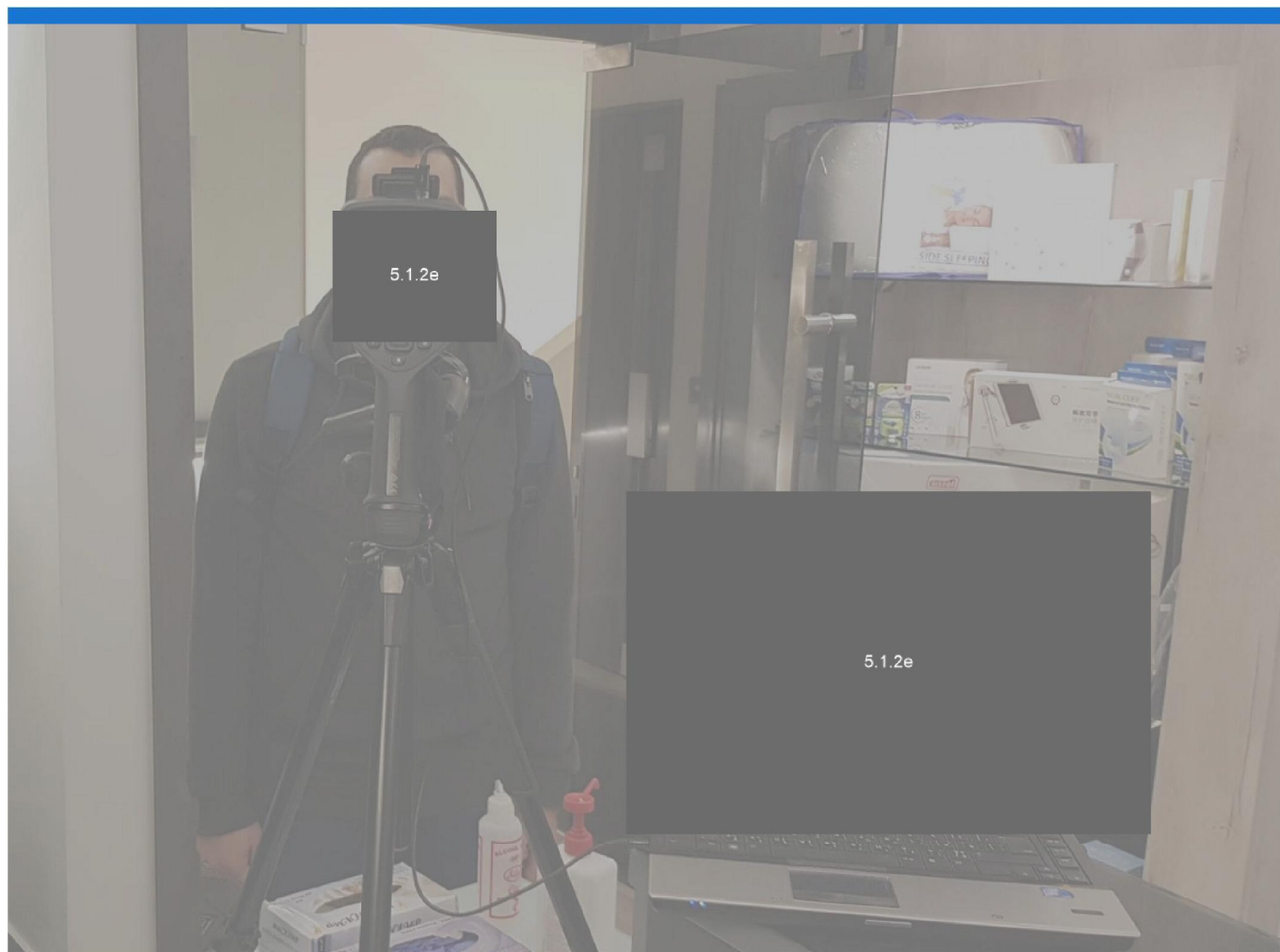


Viral:Sign



Viral Sign Explained

Hello my name is [redacted] and I am talking in this presentation about what we learned about COVID and thermography.

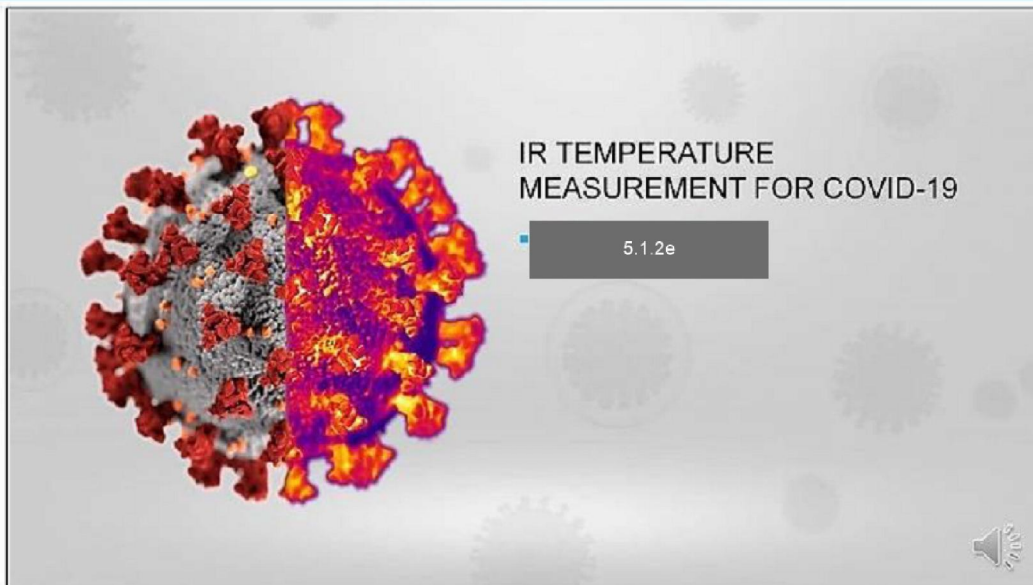
Topics:

- Detect asymptomatic people infected with COVID.
- Why Viral Sign can detect asymptomatic people.
- Research we did with Viral Sign.
- Results.


5.1.2e

Thermografie Centrum EU
KvK number: 80570984
The Netherlands
www.viral-sign.infraroodcamera.eu

Viral:Sign



WHAT IS COVID-19 INFECTION?

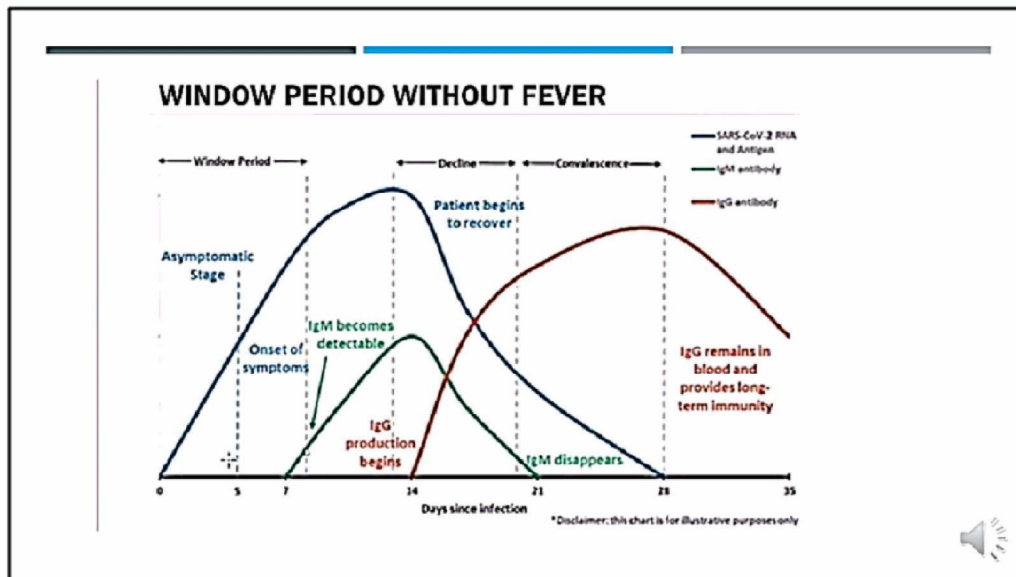


Tekronoma, MN et al. Coronavirus Disease 2019 (COVID-19) as a Multi-Systemic Disease and its Impact in Low- and Middle-Income Countries (LMICs). *314* *CNSPECT. Clin. Med.* (2020).

SYSTEMIC INFECTION	SYSTEMIC MANIFESTATIONS
<ul style="list-style-type: none"> ■ It's not just a viral acute respiratory infection ■ IL6 release until decompensation of the inflammatory cascade ■ Endothelial inflammation: thromboembolism, DVT, AMI, CVA, ARF) ■ ACE2 receptors (lungs, kidneys, intestines) ■ Skin lesions 	<ul style="list-style-type: none"> ■ Cough ■ Runny nose ■ Sore throat ■ Shortness of breath ■ Loss of smell and taste ■ Vomiting ■ Diarrhea ■ Abdominal pain ■ Tiredness ■ Muscles aches ■ FEVER

What really is COVID infection? It's not just a viral acute respiratory infection. It is a systemic infection. Since the beginning, there has been systemic release of several inflammatory proteins, mainly interleukin-6 (IL6), which can reach the decompensation of the inflammatory cascade, with inflammation of the endothelium, which can cause thromboembolism, DVT, heart attack, stroke and renal insufficiency. This is due to endothelial inflammation caused by the binding of the virus to ACE2 receptors throughout the body, especially in the lungs, kidneys and intestines. It may even cause skin lesions. The symptoms are not limited only to those of a respiratory infection such as cough, runny nose, sore throat, shortness of breath, loss of smell and taste. But also, from vomiting, diarrhea, abdominal pain, tiredness, muscles aches and FEVER.

Viral:Sign

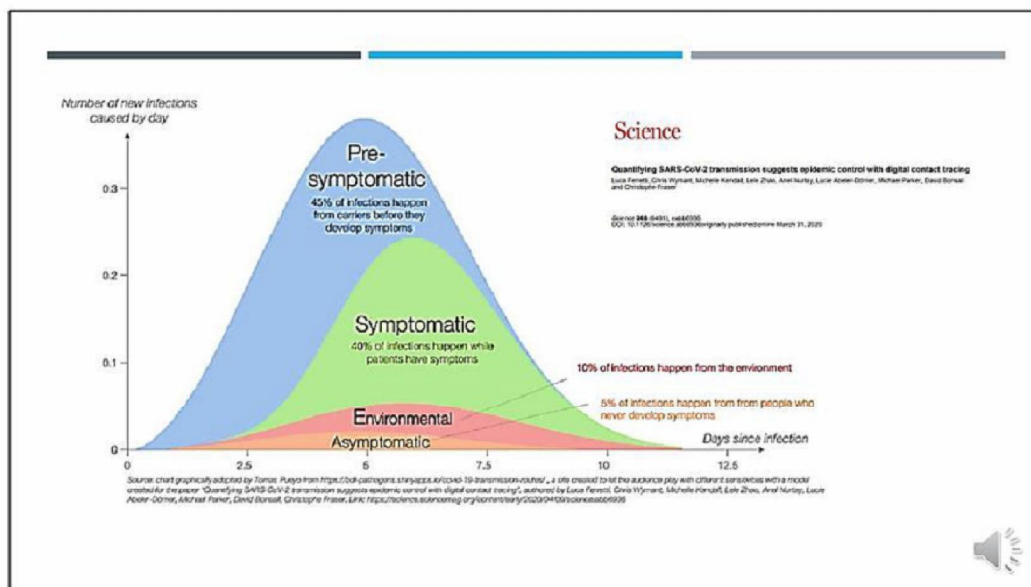


The evidence clearly shows that this type of test is likely to be ineffective in limiting the spread of COVID-19. Thermal screening is noted to be high cost and resource intensive. Detection rates are very low due to large proportion of cases that have no symptoms, are infectious before showing any symptoms or who do not present with fever.

The more you actually understand this virus, the more you begin to know the temperature taking is not effective at all [...] If we have a significant number of asymptomatic or pre-symptomatic people (WITHOUT FEVER), that also even reduces the effectiveness even more.

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5% of infections happen from from people who never develop symptoms!



What is Elevated Skin Temperature EST? An elegant way of saying that I don't know what a fever is, or that my device doesn't measure fever?

With new COVID, 50% of people who contaminate others do not even have a fever! 5% are asymptomatic and 45% are pre-symptomatic without fever contaminating others, much more than those with fever! See this research published in Science this month.

And now in this month BBC informs, asymptomatic young people are spreading COVID and resurging growth in several countries that had already surpassed the highest infection curves.

This appears to be another losing battle for conventional thermography.

There are too much ERRORS to be corrected.

Industry thermography has no support from the medical scientific community, nor does it even have a board of experts who can develop REAL HUMAN HEALTH solutions, and not simply adapt industrial solutions.

Step 1

Based on all these points, and with the beginning of the growing situation of new-COVID in Brazil, we started our research at the University of São Paulo. We divided our research into 3 stages.

Viral:Sign

METHOD

Retrospective Analysis from Data Bank

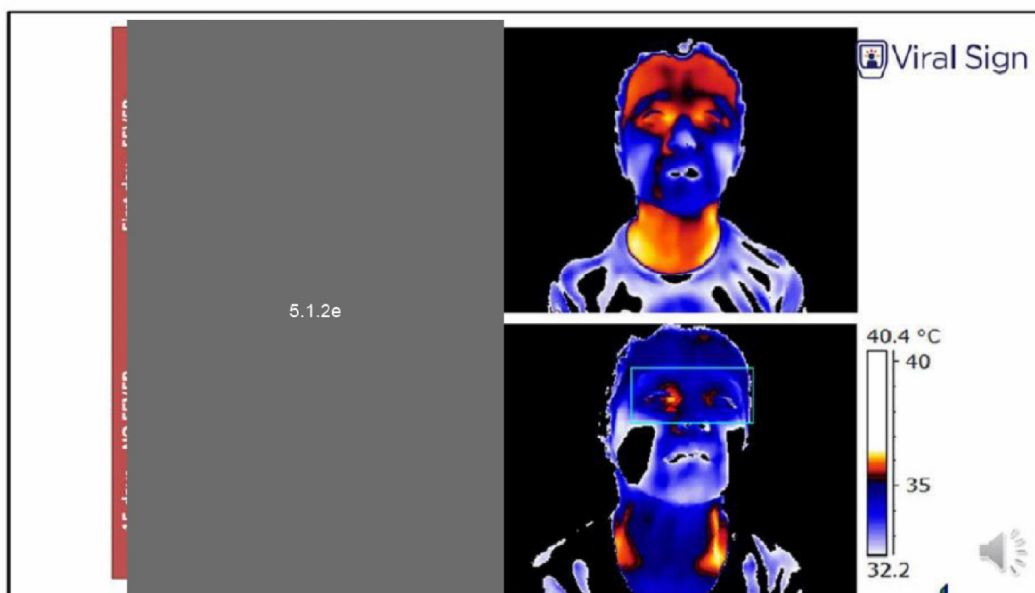
- Total 1206 patients examined between 2008 and 2019.
- Age 3 – 68 y
- 915 cases - 85% healthy
- 156 cases - 15% febrile
- 576 males / 630 womans

Urgency Unit of HCFMUSP

- Room 22- 23° C
- Thermal imaging T530sc TermoCam (Brazil)
- Emissivity 0.98
- Focal length 2 m – scanned <2 seconds
- Tympanic temperature measurement (Braun Thermoscan IRT 3520+)
- 2 measurements – T zero & T 15 days

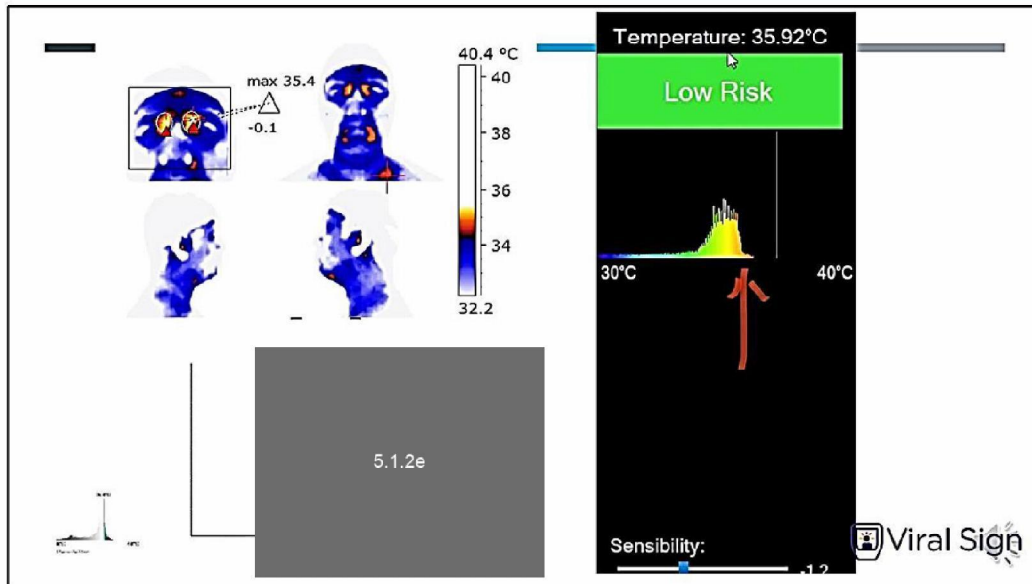


First, we conducted a survey of our database of cases attended at the Sao Paulo University emergency unit and which had a facial thermal image and tympanic temperature measurement. We surveyed 1206 cases of patients examined between 2008 and 2019, between 3 and 68 years of age. 85% without fever and 15% with fever (a total 165 fever cases). We had a proportional sample between men and women, young and old.

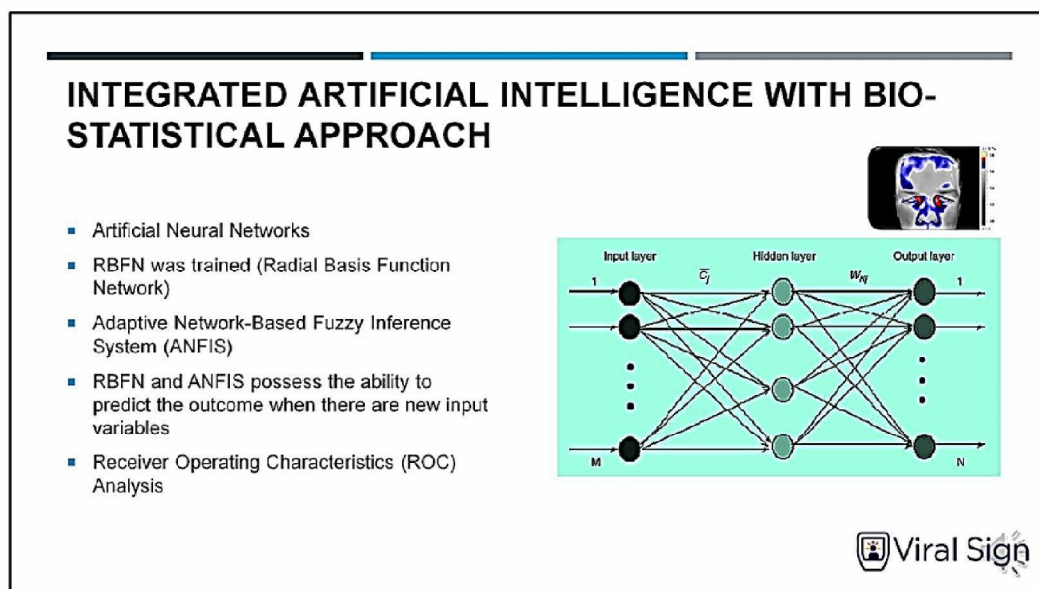


All cases recovered from fever had a second measurement 15 days later for comparison with their normal afebrile status. This thermal image of a child in a feverish state and 15 days later without a fever. The colour difference in the thermal image is clear. But how to categorize this as a fever face? For this we have developed an artificial intelligence software to recognize the feverish face.

Viral:Sign

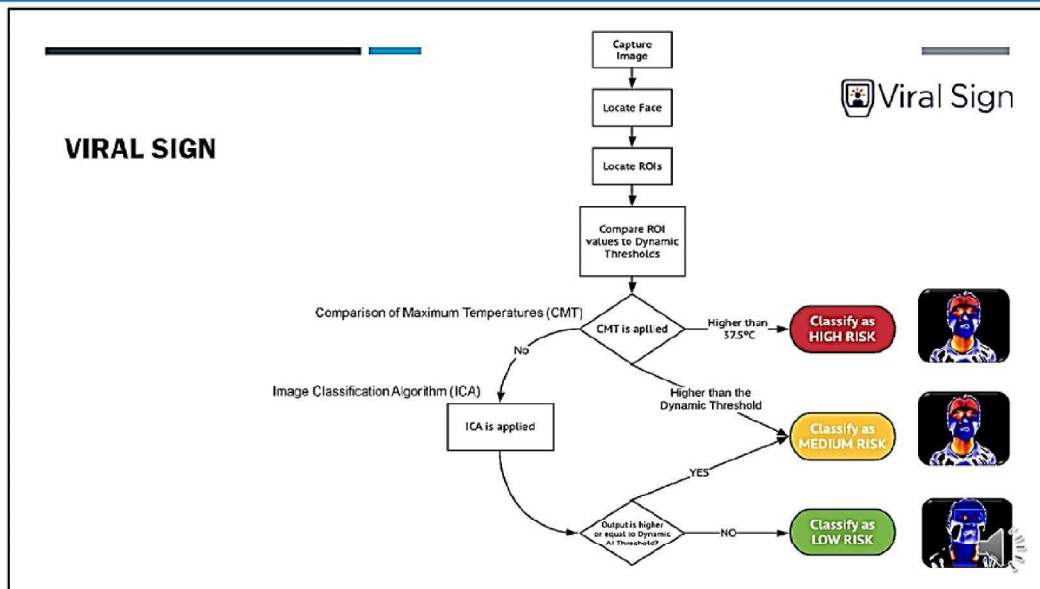


For this we have developed an artificial intelligence software to recognize the feverish face. It was based not only on the classical temperatures of maximum eye temperature, average and maximum temperature of the forehead, average temperature of the face for example, but also on all possible thermal points of the face and their combination of hot and cold areas.



It was created by Artificial Neural Networks a (Radial Basis Function Network) RBFN was trained With an Adaptive Network-Based Fuzzy Inference System (ANFIS). RBFN and ANFIS possess the ability to predict the outcome when there are new input variables. An all the data was analysed statistically by the Receiver Operating Characteristics (ROC) Analysis.

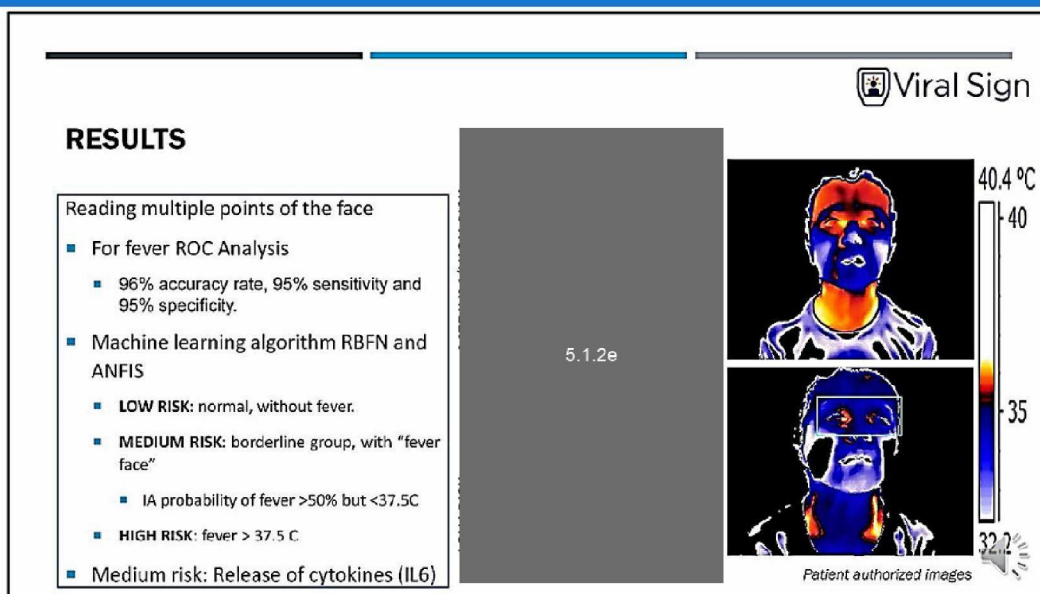
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Then we create an evaluation diagram. Where the face is automatically located within the captured image, as well as certain ROI and its comparison with cut-off values. The software applies the comparison of maximum temperatures (CMT). A cut-off value was the thermal information of 37.5C that classified the person as High Risk, due to fever, 100% fever case.

When he did not have this temperature, that is, he did not have a fever, an Image Classification Algorithm (IMA) was applied to the colour image to classify how many % the person was close to having a feverish face. When greater than 50% the system classified it as medium risk, and when less than 50% low risk.

Viral:Sign



Viral sign was born. Based on all these premises I related before, we developed a machine learning algorithm for the system of reading multiple points of the face that could classify people as low, moderate, high risk of infection, and not simply fever. The ROC analysis shows 96% accuracy, 95% sensitivity and 95% specificity.

Machine learning algorithm RBFN and ANFIS classified correctly:

LOW RISK are normal cases, without fever.

HIGH RISK those with a fever greater than 37.5 C

MEDIUM RISK: we identified a borderline group, with "fever face" but temperature below 37.5 C

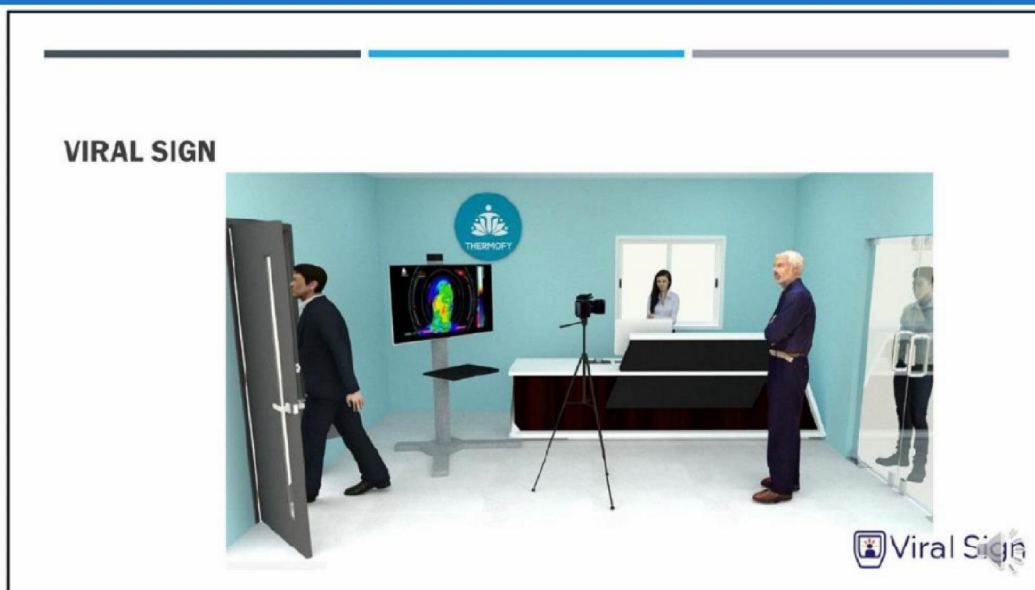
We call our system Viral Sign. That is, an artificial intelligence (AI) that could identify SIGNS of the viral presence, based on the systemic reaction by the release of cytokines (IL6) by the human body.

Step 2

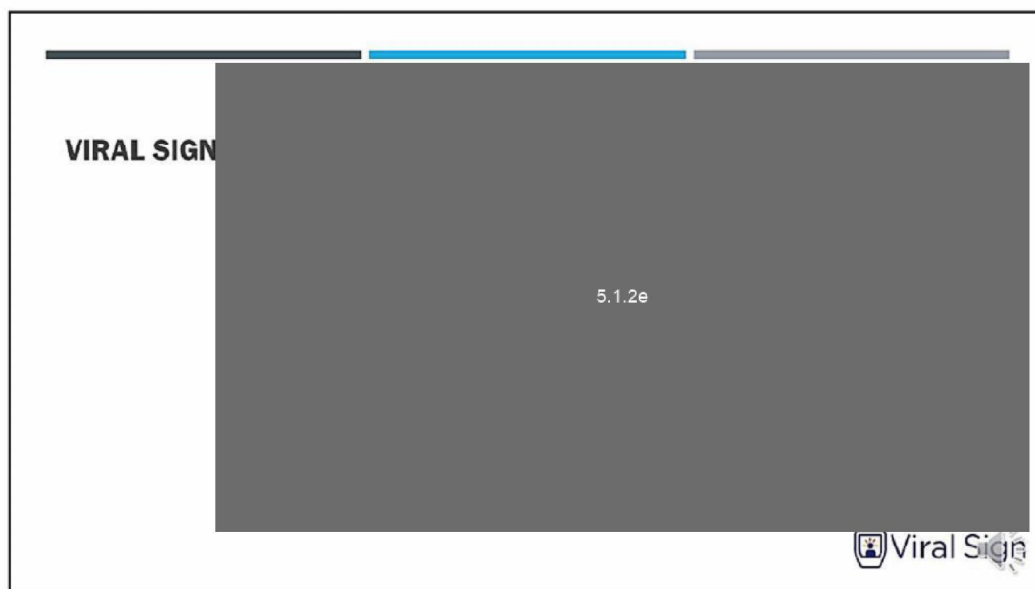
Since we had arrived at an interesting analysis software with good results within the retrospective sample, we started to put it into practice, to do the real test with COVID.

This was step 2. The prospective study.

Viral:Sign



Using the thermal camera connected to the Viral Sign software we tested in an controlled environment. And it works very well in the initial analyses.

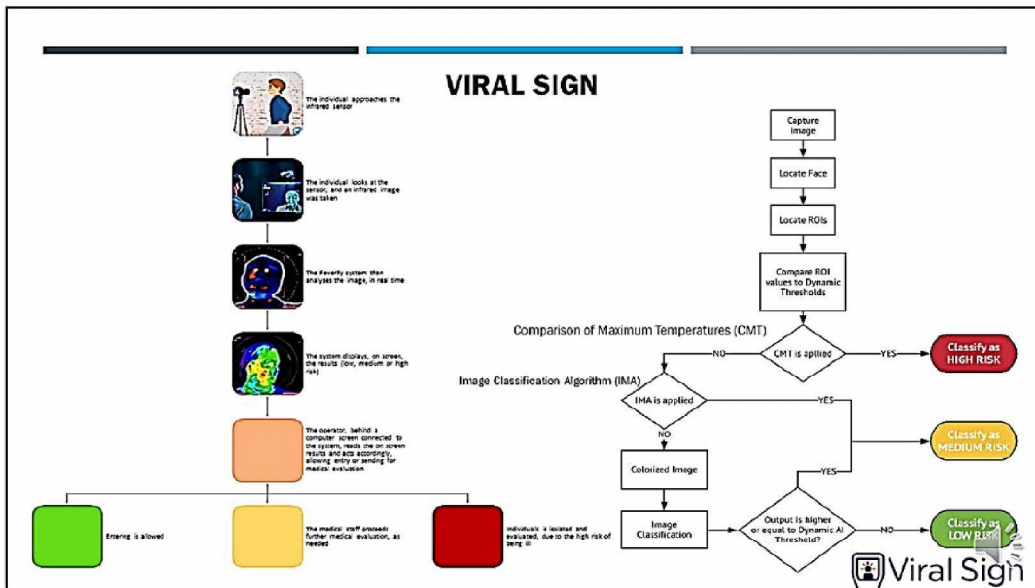


[Mouse click on photo the video start playing \(internet needed\).](#)

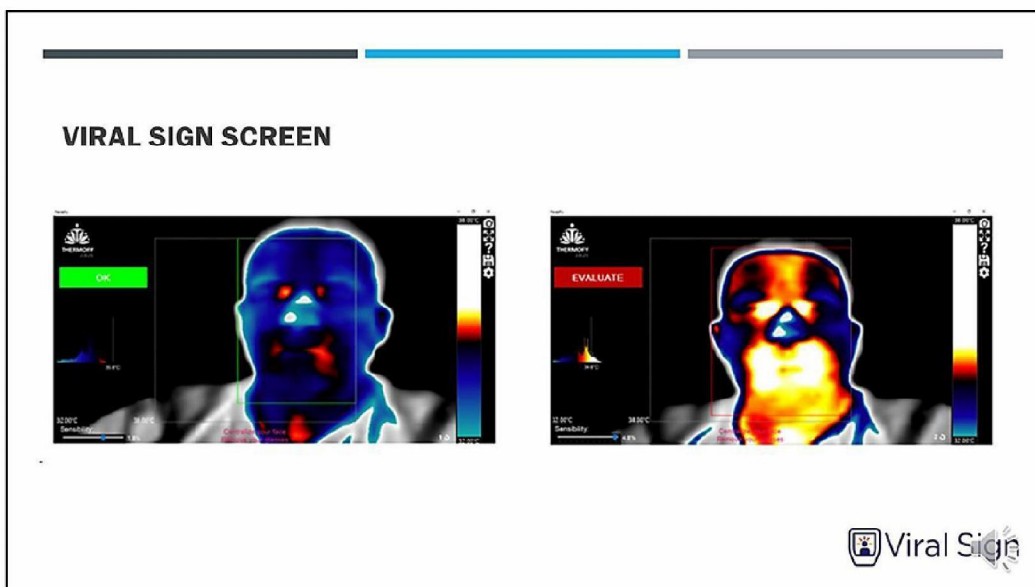
Then we increase the challenge using it in an uncontrolled environment.

As this one in our external entrance of companies the same in factories industry and hospitals. And opened big space as in airports.

Viral:Sign



We used the same diagram analysis as the initial study. However, now we would take the following intervention. To block the entry of high risk cases (fever), release the entry of low risk, and clinically address those of medium risk, with health staff or local doctors.

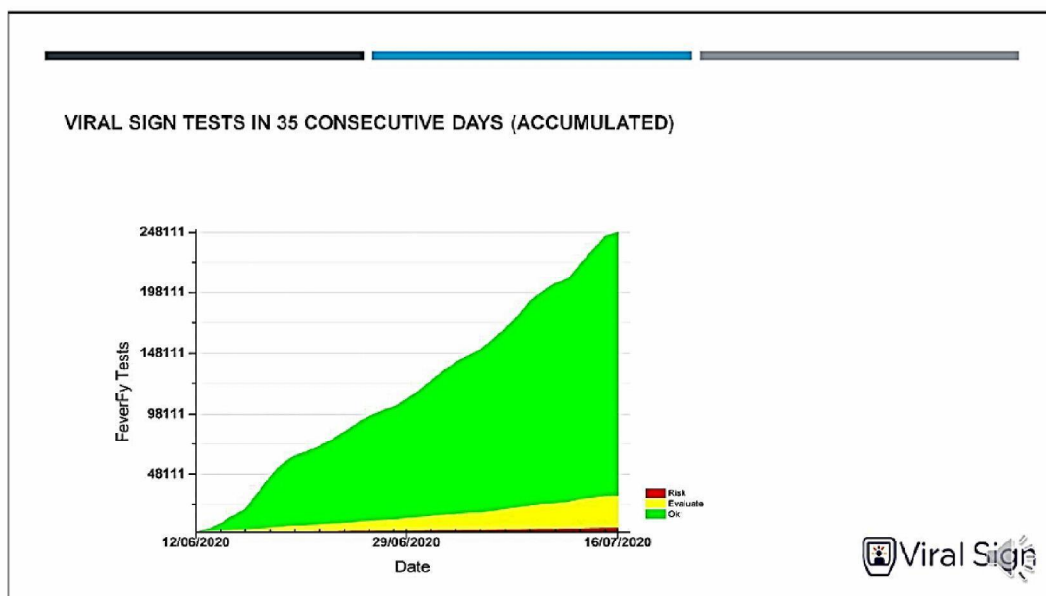


The Viral Sign system is very intuitive and simple to work with, displayed the different colours on the screen it does not need any interpretation It has audible alert it warns you if the person is medium or high risk, it shows the person thermal image without displaying the real face respected the legal privacy of each employee that is very important. The system has different colours on the screen that are not

Viral:Sign

conventional. The colours in the image are not aleatory. They are chosen to give maximum contrast with the right emissivity.

You do not need to correct anything about the temperature because it works in combination with distribution and thermal variance for mapping and not with absolute values like industrial thermography. With the start of the new Covid I waste no time I wrote the whole concept like as a magician showing the rabbit in the hat. I explained my concept with my team in 5 countries at the same time United States, Brazil, Mexico, Holland and Libanon.



There were made 248,111 FeverFy assessments between June 12 and July 16, 2020 (total of 35 days), with 218,167 individuals (88%) in normal range and 29,944 individuals in abnormal state, 12% (being 26,232 (10.57%) assigned to be evaluated/medium risk and 3,712 assigned as Fever (1.49%)).

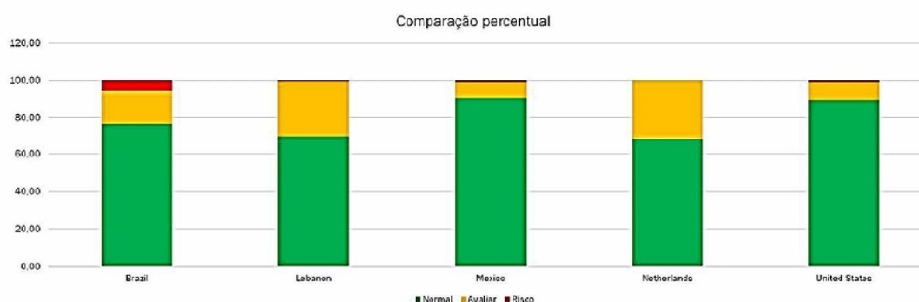
Viral Sign

	RISK			Total
	LOW	MEDIUM	HIGH	
BRAZIL	89625	20754	6735	117114
LEBANON	411	177	2	590
MEXICO	80098	7923	691	88712
NETHERLANDS	37	17	0	54
UNITED STATES	18312	2048	166	20526
TOTAL	188483	30919	7594	226996



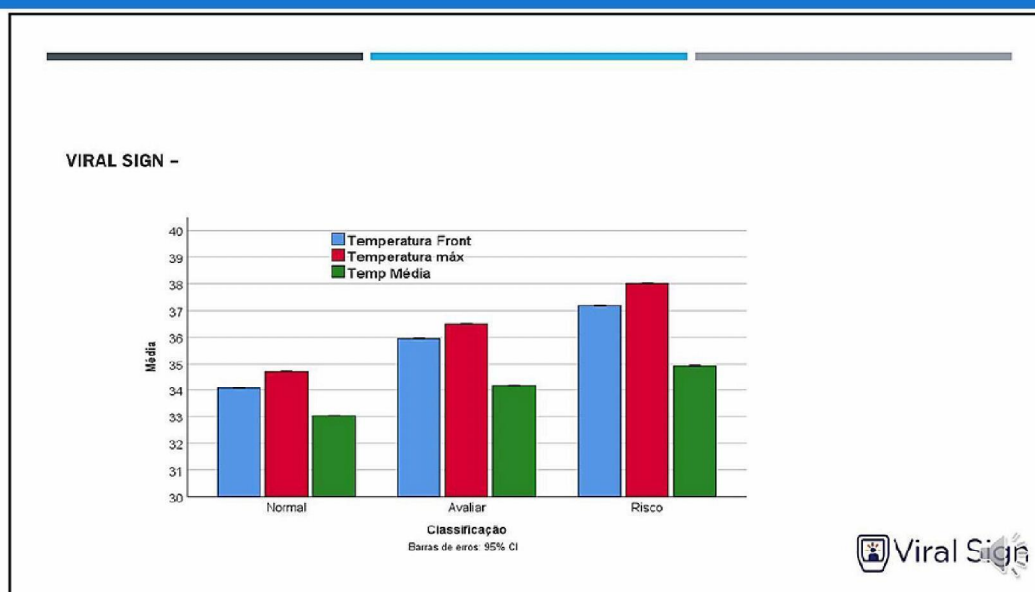
THESE are demographic numbers. The main countries that we analysed in number of cases were Brazil, Mexico and the USA.

VIRAL SIGN – FEVER WAS A RARE EVENT <1% IN ALL COUNTRIES



What surprised me most was that less than 1% of cases had fever (red line). This proved that thermography by measuring only a fixed temperature above 37.5C would be something unusual to happen, as other scientific publications have already noted in other kind of viral infections. But one thing that immediately caught our attention was the number of medium risk cases that were being evaluated by companies according to our risk protocol. Around 10% of the people evaluated were of medium risk.

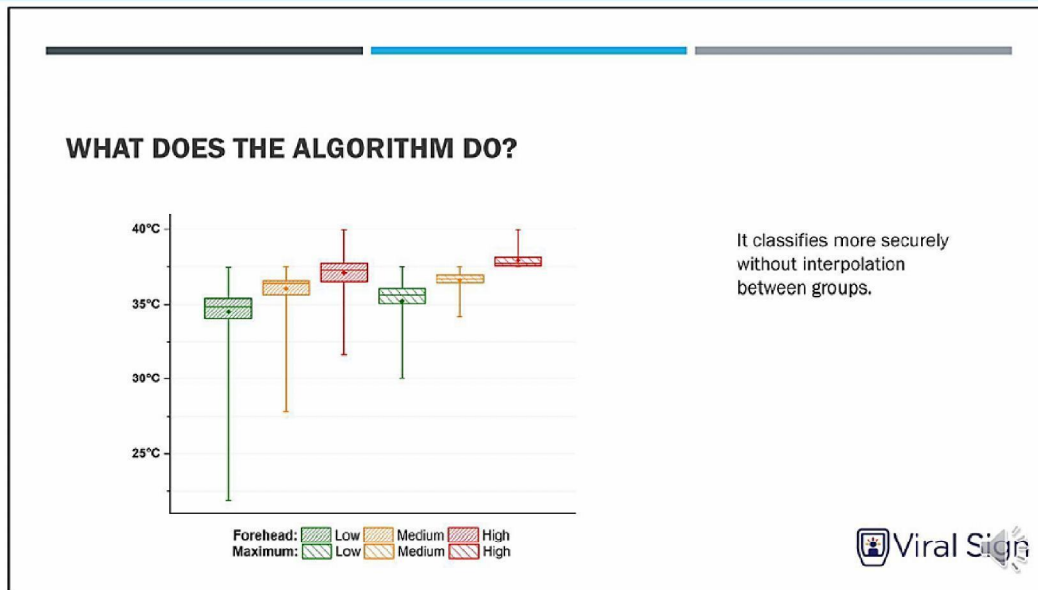
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Analysing some classic measurement like maximum face temperature we observed the difference in the 3 groups. Remember that the algorithm analyse this and hundreds of other things together that cannot be represented in the graphics.

All ANOVA comparisons given significant with p value <0.001 with tukey's post hoc. The 3 groups were significantly different and therefore there was an important in unprecedented intermediate group never reported in medical literature. We discovered a medium risk group which was not a negligible in our sample. That is many people have a fever face but no fever 10%.

Viral:Sign



What does the algorithm do?

It classifies more securely without interpolation between groups. For example a value of t_{max} of the face of 37C could be both a suspicious case and a normal case, the algorithm based on other measures does not let this happen and classifies correctly in a single category.

We really discovered something important, a **medium risk group**, which was not negligible in our sample. That is, many people had a fever face but no fever (10%).

So if it were just the temperature we would have a distinction but not a precise classification, and we would fall into the same situation as the Ng Singapore study beginning of this presentation. We didn't had missed fevers nor false alarms with reduced thresholds.

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Step 3

So the software Viral Sign analyses the thermal distribution and combination of different temperature points in search of a pattern called FEVER FACE.

But the job doesn't end there. Our greatest interest was to know if the MEDIUM RISK group would really have any clinical importance or not.

In order to know this, we selected one of the companies that can perform the PCR test on all people and evaluate all people clinically by medical doctor staff. And this place was located in a rural area in Bahia with 638 employees. Scanned at once by the sensor.

CLINICAL EVALUATION AT BAHIA

- 638 people:
- 475 LOW RISK > no fever
- 157 MEDIUM RISK > no fever > 8 COVID (+)
- 6 HIGH RISK > confirmed fever
- Contamination ratio is 1 to 8 for COVID



Of these 638 people, there were

475 **LOW RISK**

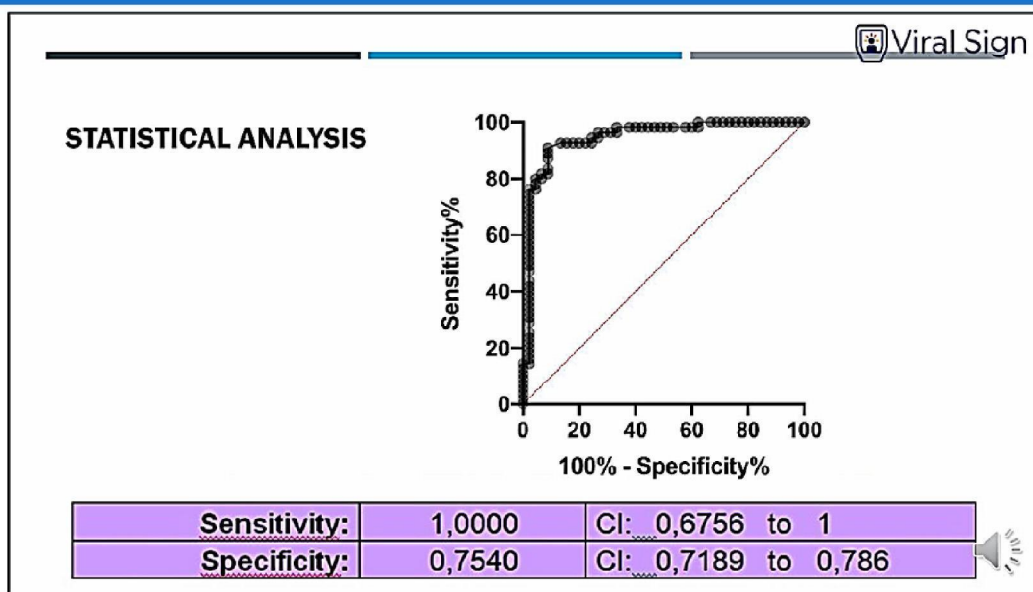
157 **MEDIUM RISK**

6 **HIGH RISK**

All cases of COVID were identified and confirmed only in the MEDIUM RISCO group. That is, if we were using conventional industry thermography, everyone would be in the company and contaminate people inside the workplace. This is 8 cases. Although only 8 cases were confirmed in the Medium Risk, this is important.

Recalling that the contamination ratio is 1 to 8 for COVID (that is, with the potential that in 3 generations we would all have been contaminated within the company, apart from the contamination of family members).

Viral:Sign



CONSIDERING JUST CASES OF COVID Viral SIGN identified them all !!

Sensitivity 100%

Specificity 75.4%

The important thing here is that the normals were really normal 100% sensitivity.

And the suspected cases of COVID got it right at 75% and infection 80%, it doesn't matter. The fact of being suspicious (medium / high risk) already brings a high rate of accuracy and helps in the intervention that must be taken in this epidemic situation.

OTHER INFECTIONS AND PROBLEMS BEYOND COVID

- 4 rhinitis
- 2 influenza
- 1 urinary tract infection UTI
- 1 dengue fever
- 1 erysipelas
- 1 rosacea

Viral Sign

Among the other infections identified clinically or by examination we find:

1 urinary tract infection, 1 dengue, 1 erysipelas, 1 rosacea, 2 common colds, 4 rhinitis.

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SYMPTOMS IN MEDIUM RISK GROUP (15% SYMPTOMATIC)

- Coryza
- Headache
- Dry cough
- Diarrhea
- Odynophagy
- Hoarseness
- Nausea
- Vomiting
- Myalgia
- Anosmia
- Nasal obstruction



The medium-risk group had symptomatic and asymptomatic people. Among the clinical symptoms found in the medium-risk group. Coryza, Headache, Dry cough, Diarrhea, Odynophagy, Hoarseness, Nausea, Vomiting Myalgia, Anosmia, Nasal obstruction.

OUR RECOMMENDATION

- **LOW RISK:** release
- **MEDIUM RISK:** evaluate all clinically and do not hesitate to ask for a COVID test if in doubt.
- **HIGH RISK:** prevent passage. You already have a fever.



Our established recommendation was

LOW RISK release

MEDIUM RISK evaluate all clinically and do not hesitate to ask for a COVID test if in doubt.

HIGH RISK prevent passage. You already have a fever.

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WHY HAS NOT BEEN IDENTIFIED COVID IN HIGH RISK (FEVER) GROUP?

- Because when a person has a fever in COVID, they are already very weak, they go straight to the hospital.
- Those who have a fever and go to the company already know the problem they suffer, UTI, Erysipelas, etc.



UTI = urinary tract infection

ANALYSIS BY ARTIFICIAL INTELLIGENCE

- Thermography has principles and multipoint analysis will always be a foundation that cannot be violated in medical practice.
- Only people who do not have a deep knowledge of human biology will persist with a single point measurement on the face to diagnose fever/EST.



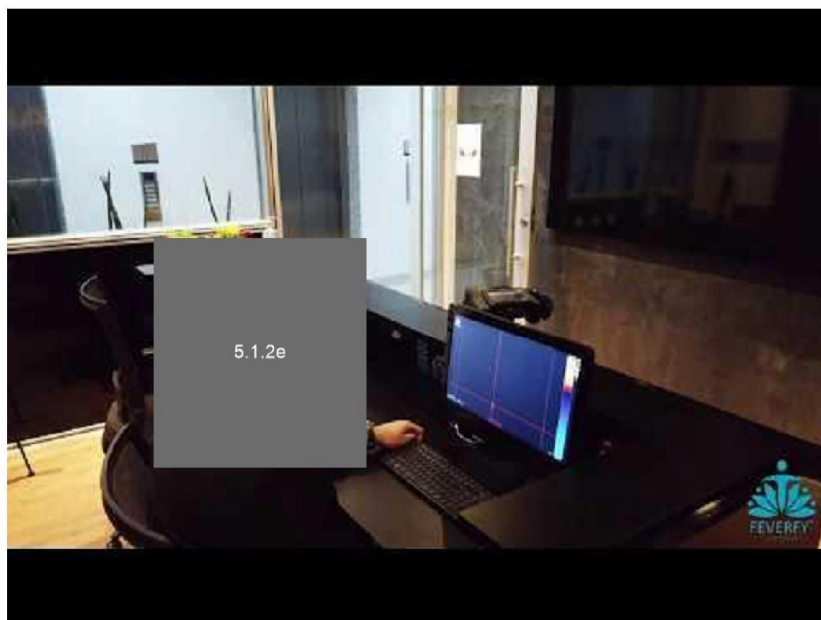
EST = Elevated Skin Temperature (conventional infrared cameras doing)

Viral:Sign

What have we learned about new COVID and thermography until the moment?

CONCLUSION:

- * Fever is a rare event !!
- * Identification of suspicious cases is only possible with analysis of several face temperature points.
- * The vast majority of the thermography industry is totally unprepared to deal with emergency situations in the medical field involving thermography. They don't have medical/social responsibility to deal with viral pandemic!!
- * There is a need for greater integration of the industry with medical thermologists and medical thermology associations, and less market speculation.
- * In less than 1 month, hundreds of thermography companies have appeared that we had never heard of, "concerned with COVID" and do not even have a scientific medical staff. In summary products without any support, studies or publication from the medical community.
- * Viral Sign is the first solution supported by the scientific community, and the largest trial to date. The system that most identified suspected and confirmed cases of viral infection (COVID) to date.
- * **The medium risk group should be included in the screening for viral contamination.**



Mouse click on photo the video start playing (internet needed).

Email: 5.1.2e@infraroodcamera.eu Email response 7 days a week also in the evening.

Website: www.viral-sign.infraroodcamera.eu

Complete the quotation form at the website and we will contact you within 24 hour.