# Development of an automatic device for the administration of mother hen uropygial secretion analogue in hatching eggs and its effect on vocalization at hatch

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## Introduction & Objectives

Day-old chicks are exposed to multiple stress factors from pre-hatch to housing on the farm. These stress factors can lead to welfare issues, immunodepression, and decreased productivity. The mother hen uropygial secretion analogue (MHUSA) is a synthetic analog (SecureChick®) of a maternal semiochemical secretion produced by the uropygial gland. The application of MHUSA has demonstrated its potential to reduce stress-related reactions in chicks as well as to influence their behaviour. This benefit can be assessed through vocalizations. Vocalizations are the sounds emitted by the chicks and can be used to determine their welfare status during the hatchery processing.

The objectives of this study were to develop an application system to administer the pheromone in the hatchers and to study the effects of the application on the day-old chicks through the evaluation of vocalizations.

## Materials & Methods

The study was conducted in a commercial hatchery. To carry out the **first objective** of the study, three tests were performed. The first two tests focused on developing the prototype and testing the application concept. The third test was aimed at validating the administration of the pheromone through this application system (Figure 1).



Figure 1. Images from the different parts of the prototype during the developing of the application device.

For the **second objective** it was used fertile eggs from two distinct broiler breeder flocks of the Ross 308 variety. A total of 190,080 embryonated eggs were selected and randomly distributed in to two treatment groups: Group 1 – treated with pheromone (2 hatchers Chickmaster®, capacity 31,680 eggs) and Group 0 (control) – without any treatment pheromone (2 hatchers Chickmaster®, capacity 31,680 eggs). The Group 1 was treated with a single application of the pheromone solution. A commercial batch of SecureChick® was applied on the eggshells and hatchers surfaces through the prototype designed, the application had a total duration of 8 minutes. It was made 48 hours before hatch using 25 ml per 1,000 eggs (a total of 792 ml of SecureChick® per hatcher was used).

To assess the effect of MHUSA a microphone was placed in randomly selected trolleys carrying the day-old chicks' boxes from both groups to record the sounds per box for 90 seconds each time at three different levels of the trolley (top, middle and bottom). A total of 66 sound recordings in two rounds were analyzed with the algorithm developed for this purpose. It was used the Python programming language and for feature extraction the following sound characteristics were considered: amplitude, spectral centroid, bandwidth and zero-crossing rate. This process allows to automatically identify differences in the vocalizations between the groups. The model used to perform the statistical analysis was the Random Forest.
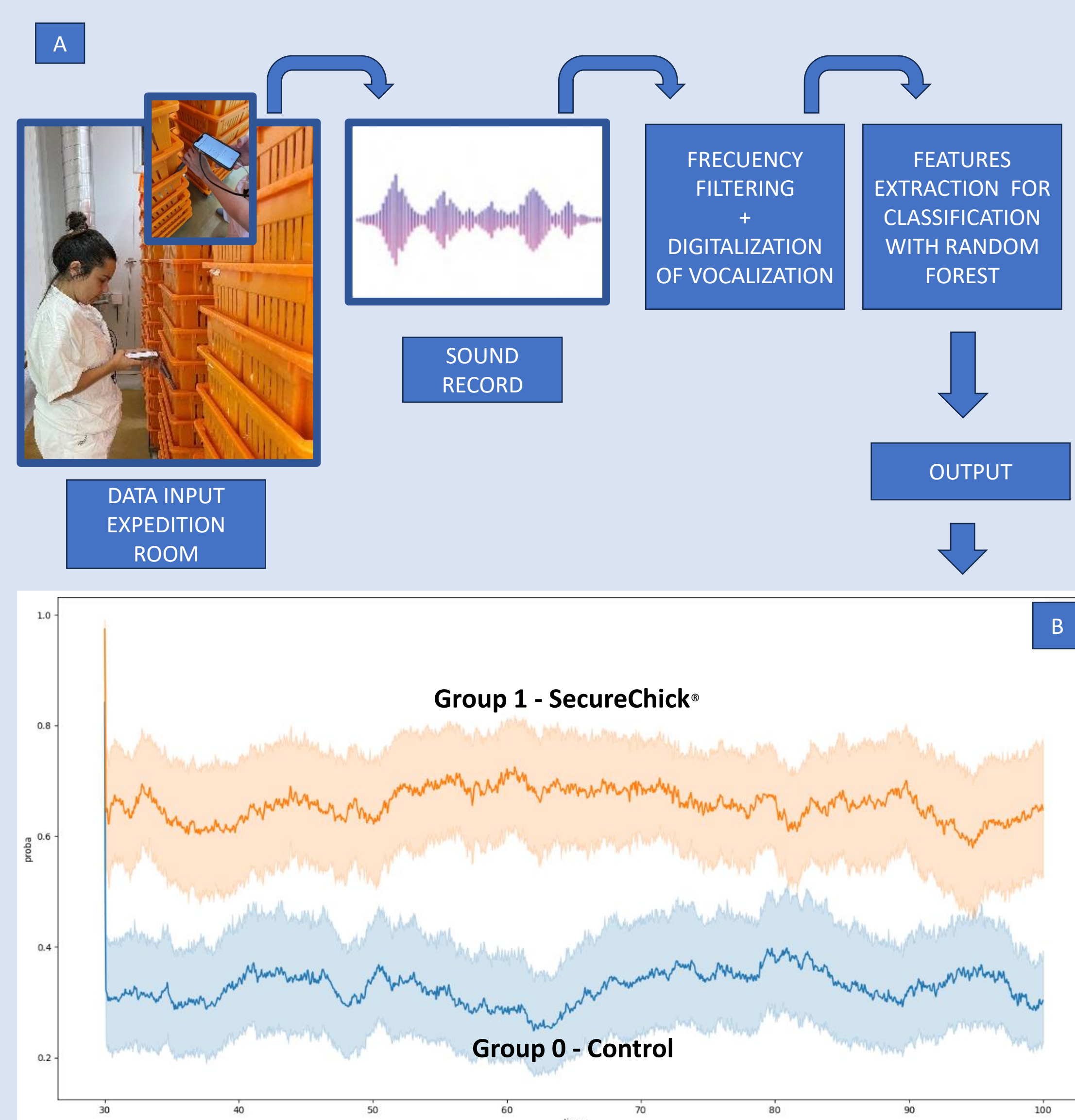


Figure 2. A. Schematic view of chicks' vocalization assessment through signal processing. B. Time series curve showing the average probability of the classification for the 2 treatment groups: Pheromone (SecureChick®) treated group (1) vs control group (0).

## Results

The algorithm applied techniques to process the field audio recordings of multiple vocalizations (100 day-old-chicks per box) such as frequency filtering, signal reconstruction and feature extraction. Due to the model selected it was possible to use several machine learning algorithms to automatically identify differences in the vocalizations between the two treatment groups.

The statistical analysis revealed that the two different vocalization patterns detected for the two groups under study presented significant differences. The effect of the pheromone was reflected by the more frequent identification of comfort vocalizations, higher probability (0.65-0.80) in the treated group versus the control group. The curves using the selected classifier shows the average probability around the mean for multiple sounds in the time, classifying as a Group 1 'comfort' for the treated group with the pheromone (SecureChick®) and Group 0 'distress' for the control group (Figure 2).

## Conclusions

In conclusion, the results obtained show that **the automatic application device is a suitable application alternative**. Given that:
- There is 'pheromone intake' after spraying the hatching eggs in the hatcher confirmed by the sound analysis performed.
- The effect of the pheromone is reflected by the two distinct patterns of vocalizations between the chicks treated with pheromone (SecureChick®) versus the control group.