

CRITICAL REVIEW: AUDIO SIGNAL PROCESSING FOR DYNAMIC NOISE MAPPING IN SMART CITIES BY *FRANCESC ALIAS*

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Abstract. This is a review on the presentation "*Audio Signal Processing for Dynamic Noise Mapping in Smart Cities*" delivered by *Francesc Alias* on November 22nd, 2017 at O.C. Zienkiewicz Conference Room, C1 Building, UPC Campus Nord, Barcelona. The quality of the presentation (i.e., the way information was conveyed) and the technical aspect of the speech content are addressed in this critical review

The presentation starts of with a brief review on human hearing range in terms of sound frequency and its relation with the hearing sensitivity. The presentation introduces the concept of A-weighting, which is a weighting of the sound power level taking into account the human hearing sensitivity for distinct audio frequencies, leading to the power level in dBA units. This is a more accurate parameter for noise level. Also, the equivalent continuous pressure (L_{eq}) level is introduced. This parameter takes into account not only the power of the noise but its duration over time.

The machining hearing process for the sound recognition is presented in details with good practical examples. The filters (MFCC or GTCC) applied in the noise signals are based on an average human hearing capacity. After the filtering processes those signals are compared with labelled sounds(i.e., sounds with known nature) in order to perform the noise recognition.

After this background review, the public health problem related with noise was brought about. Some important and surprising figures on Barcelona and EU noise pollution are showed. At this point, the concept of Noise maps is introduced. Those maps offer a overview of the noise pollution level within a determined geographic region,thus offering a tool for decisions about measures to reduce noise pollution.

Nowadays, as shown in the presentation, those noise maps are updated after every 5 years in average. Given the dynamic of a populated environment, those maps are not up to date in relation to new environmental changes, therefore are not a reliable source of information on noise pollution.

At this point, Dynamic Acoustic Maps, regarded as Real time (updated every 5 min in average) noise maps come into play. Those Maps are a result of the new complexion brought by the concepts of smart city and IoT (internet of things). Their implementation

are based on a Wireless Acoustic Sensor Network (WASN) collecting data in different sites of the city.

Many challenges are involved in the implementation of a WASN , such as costs, selection of sensor, positions to collect data, data processing, robustness and reliability. Also, it was stressed by the lecturer the challenge to evaluated noise level and generate Dynamic Acoustic Maps when anomalous noise event(ANE) are presented. Complex algorithms (ANED) for detection of ANE are developed which require a enormous amount of time to the machine hearing process over audio database of the targeted environment.

As a personal perception, it was clear the subjectiveness of the definition of an ANE and a regular noise event, remaining as a challenge in the ANED employment.

When it comes to way those information were communicated to the audience, some points worthwhile to mention. In general, the lecturer used too much text in his presentation, sometimes with small caption. Unnecessary animations were employed. No explanation on charts content was provided before talking about them. The positive points of his presentation were the structure which provided a good background for understanding the seminar content. Also, his good examples, with resources such as audio clips which ease the understanding of important concepts and definitions.

It was clear that a successful application of a Dynamic Acoustic Mapping can provide a framework for evaluation of noise level which can ease authorities and society in general to work towards the mitigation of noise pollution for a healthier society.