\chapter{Conclusions}

\label{sec:conclusions}

The purpose of this work was to design an efficient tool for audiologist by using a parallel algorithm.

We expanded the work of \cite{Saboddd2013682} to measure \ac{anr} and \ac{jnd}.

To obtain a real-time response, we implemented both \ac{anr} and \ac{jnd} on a GPU, which improved computing speed by 200\%. However, the main improvement consisted of changing the input calculation to avoid a decrease in precision when time increases due to the limitations of the 32 bit floating point standard.

This approach allowed us to use the GPU to calculate 2.24~s of audio instead a mere 80~ms, which is a factor-of-28 improvement from parallelism.

The original program allows for a single signal evaluation by adding overlap for the interval. By implementing a selection mechanism to prevent some of the blocks from calculating the overlap, we now solve for multiple signals at once.

In addition, by using \cite[Eq.~17]{furst2015}, we can simulate the JND of a single tone at 0.15~s by testing an interval of 40~ms and multiplying by a factor. This strategy further optimizes the construction speed of the JND database for auditory damage. We also generated the same signal waveform and noise waveform at different powers on the GPU, which avoids creating long signals on the CPU. The program was also modified program to share memory with Matlab, which leads to an order-of-magnitude improvement to the run time. These improvements combine to increase by a factor of 720 the database generation, so \cite{odedst2017} can create 1000 profiles in less than four hours instead in about 3.5 months.

The algorithm operating system for searching the database and for real-time measurements of the effectiveness of prescription methods opens the door for clinical audiological diagnosis and HA fitting. Thus, this tool can be used to rapidly adjust HAs and reduce the return rate due to incorrect prescription. The improvement of HA fitness should also help \ac{chh}, who depend on proper hearing to develop communications skills.