Based on dynamic neural fields \cite{1}:

Create a computational model that accounts for human “biases” (such as the ventriloquist effect) and, in the longer term, includes active perception in order to support the development of more natural interactions (e.g. with a human environment).

Part of the AMPLIFIER project ⇒ applications to social robotics + validation by psychophysical experiments.

**References**


**Objectives**

- Improve the way social robots interact with people, starting with the way they perceive their environment.
- Particular focus on multimodal merging + role of active perception.
- Sensor fusion performed very efficiently in human brains ⇒ inspiration from psychology and neuroscience (e.g. the ventriloquist effect, where one modality takes over another for determining the perceived location of a sensory cue).
- Part of the AMPLIFIER project ⇒ applications to social robotics + validation by psychophysical experiments.

**Hypotheses**

Model inspired from the superior colliculus (SC):

- Subcortical region involved in both multimodal merging and saccade generation.
- Receiving visual, auditory, and even somatosensory inputs.
- Aligned receptive fields: visual, auditory and somatosensory signals at a same location activate the same region of the SC.

Reproducing the topology of the SC with a logpolar transformation:

\[
\begin{align*}
    x &= B_x \log \left( \frac{\sqrt{p^2 + 2Ap \cos \phi + A^2}}{A} \right) \\
    y &= B_y \arctan \left( \frac{p \sin \phi}{p \cos \phi + A} \right)
\end{align*}
\]

Since the retina has a denser distribution of sensors at its center, visual cues will activate more SC neurons when they are close to the fovea than at the periphery.

**Model**

Based on dynamic neural fields \cite{1}:

\[
\frac{\partial U(x, t)}{\partial t} = -U(x, t) + f(x, t) + \int_{\text{SC}} W(||x-x'||) f(U(x', t)) \, dx' + h
\]

\[
W(D\Delta x) = A_+ \exp \left( -\frac{\Delta x^2}{\sigma_+^2} \right) - A_- \exp \left( -\frac{\Delta x^2}{\sigma_-^2} \right)
\]

- Mesoscopic modeling of the SC.
- Able to merge conflicting signals and/or select one of them.
- Succeeds in qualitatively reproducing psychophysical experiments on the ventriloquist effect.

**Upcoming work**

- Retrying and improving the model with the upcoming data from AMPLIFIER.
- Applications to social robots: testing the model and comparing it to unimodal perception methods.
- Completing the model with decision-making and saccades generation.