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LSDNet: A Neural Network for Multisensory Perception

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Infant Multisensory Perception

Research on infant multisensory perception has detailed the increasing capacity of infants to differentiate stimuli when it is present to multiple sensory modalities (Bahrick (2002), Lewkowicz & Lickliter (1994)). Bahrick and Lickliter's (2002) *intersensory redundancy theory* posits a two-fold thesis to explain infant and neonate multisensory perception. In the first thesis, infant attention is directed towards amodal features when redundant sensory information is present to two or more sensory modalities. Secondly, when only unimodal input is available, attention is directed towards modality-specific features. Modality-specific features are particular for a given sensory modality (color, scent, pitch, etc), and amodal features are evident in multiple sensory modalities (rhythm, rate, tempo, intensity, etc).

Our model attempts to replicate the overall computational structure to Bahrick and Lickliter's theory and to offer validation to the two-fold thesis. Though their thesis is highly compatible to a computational approach, to date there have been no attempts to create such a model, and as such the LSDNet promises a new direction for multisensory research.

Model Specifics

Our model is a three-layered backpropogated neural network (Fig. 1). Input units consist of four auditory and four visual nodes that feed into three hidden units – two of which represent 'modality-specific' units, and one of which is an amodal representation which receives input from all eight input units. Inhibitory connections exist between all three hidden units. Output units consist of arbitrary A-B response nodes. The network is trained with two stimulus sets, one corresponding to multimodal pickup and one to unimodal pickup.

Preliminary Results

Initial results seem promising. When the network is tested with matching modality nodes, output results reflect the increased capacity of the model to pickup amodal features when receiving multimodal input. Currently we are investigating the effect of restructuring the input units so that given units will feed into the dedicated amodal hidden unit. By doing so we hope to improve upon the network's performance to more cleanly match empirical results.

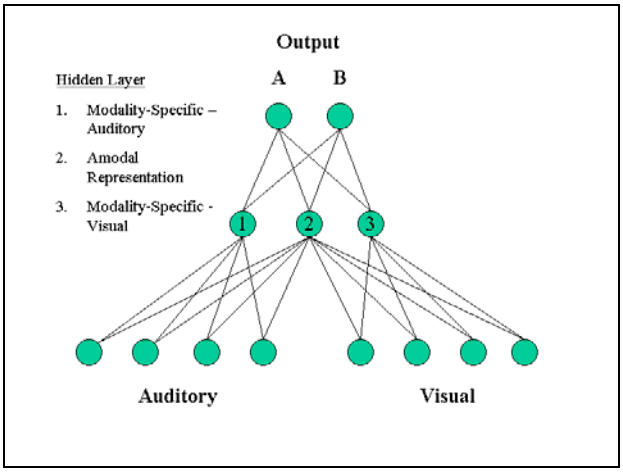

Figure 1: LSDNet

References

Bahrick, L. (2002). Generalization of learning in three-and-a-half month-old infants on the basis of amodal relations. *Child Development, 73*, 3, 667-681.

Bahrick, L., & Lickliter, R. (2002). Intersensory redundancy guides early perceptual and cognitive development. *Advances in Child Development, 30*, 153-187.

Lewkowicz, D.J., &Lickliter, R. (1994). *The development of intersensory perception: Comparative perspectives*. Hillsdale, NJ: Erlbaum.