paper summary

Methods

Basic Bayesian Observer Model

- θ_{true} = 225 degrees for all experiments. This is the mean of the prior, i.e. the direction around which all motions presented to subjects are centered
- Start one block e (~200 trials, 1 trial = 1 estimation task a subject)
    - Strength of the prior κ_p is block-specific (10,20,40 or 80 degrees) prior strength
    - create **pior distribution** as a von mises distribution $\nu(\theta_{true}, \kappa_p)$. Why this distribution because is the circular analogue to Gaussian distribution
        - [notice that prior distribution is also referred to as evidence distribution $\nu(\theta_{true}, \kappa_e)$ in star methods, but I would avoid this, it generates confusion]
    - Perform Trial i
        - Sample ***sensory evidence*** θ_{e_i} from the evidence distribution. This is the actual direction of motion for this trial.
        - The sensory evidence θ_{e_i} is also the mean of the **sensory likelihood distribution** i.e. the distribution of the direction of motion as it is *perceived* by the subject. This is also modeled as a von mises distribution $\nu(\theta_{e_i}, \kappa_e)$ with the same strength $\kappa_e = \kappa_p$ as the prior distribution.
        - Assumed that each subject has been able to learn an estimate of the prior distribution $\nu(\theta_{true}, \kappa_{prior})_{Learned}$
        - Compute the **posterior distribution and its mode with Bayes:**

          $$p(\theta_{true}, \theta_{e_i}) = \frac{p(\theta_{e_i}|\theta_{true})p(\theta_{true})_L}{p(\theta_{e_i})}$$

          Then the mode of this distribution is taken as the subject final estimate

$$\theta_p = argmax(p(\theta_{true}, \theta_{e_i}))$$

Combining the equations above (and adding motor noise (with motion strength κ_m) and lapses occurring with probability p_r, here not shown) we get the **distribution of percepts** θ_p of one subject over all trials (θ_{e_i} changes) for this block (θ_{true} is fixed)

Overall, the the basic bayesian observer model has these parameters

- θ_{true} true angle
- κ_p prior strength
- κ_e likelihood strength
- κ_m motion strength
- p_r probability of lapses