When to move on to the next raspberry bush?

A mathematical model on multi-target cognitive search optimization.

Arnab Biswas
Dept. of Biological Sciences and Bio-Engineering.
Indian Institute of Technology, Kanpur

A commented version providing more detail is available here.

What I am trying to do?

Designing a search strategy

During animal foraging-

- multiple-target searches unbounded number of potential targets.
- **question:when to stop searching?**
- exhaustive search is resource intensive.

Optimal foraging theory (MVT, Charnov, 1976)

- organism maximize its rate of energy intake, instead of consuming all available food.

- leave the current patch for the next patch when the instantaneous rate of return, drops below the average rate of return.

Hypothesis

organisms estimate the average rate of return and monitor the current rate of return (subconsciously) and leave the bush when current rate falls below the average rate.

Why am I trying to do this?

How I plan to do it.

The parameters I will be measuring

- Time before first target was found and how it varies with distribution.
- Time after last target was found and observer move to next search scene.
- False alarms variation with distribution.
- variation of search satisfaction error with different target distributions.

$$\mathbf{E}\left[\frac{T-F}{N-F}|F,S\right]=\sum_{T}\frac{T-F}{N-F}P(T|F,S),$$

$$\Pi=\frac{\mathbf{E}\left[\frac{T-F}{N-F}|F,S\right]}{\gamma}.$$

References

Elazary, L., & Itti, L. (2010). A Bayesian model for efficient visual search and recognition. *Vision Research*, 50(14), 1338-1352, doi:10.1016/j.visres. 2010.01.002.

Charnov, E. L. (1976). Optimal foraging, the marginal value theorem. *Theoretical Population Biology*, 9, 129–136.

Wolfe .When is it time to move to the next raspberry bush? Foraging rules in human visual search *Journal of Vision* (2013) 13(3):10, 1–17.

Stephens, D. W., & Krebs, J. R. (1986).*Foraging theory*. Princeton, NJ: Princeton University Press.

Wolfe, J. M. (2010). Visual search. *Current Biology*, 20(8), R346–R349, doi:10.1016/j.cub. 2010.02.016.