

An Analytical Approach to Optimizing The Utility of ESP Games

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Motivation

- ESP games annotate images on the web.
- Can we optimize the goodput of the game?
- Service provider can utilize our model to improve their system.

Idea

- Model the performance of the game and optimize it.
- A more generalized ESP game.
 - The number of players can be more than 2.
 - The consensus threshold can be any positive integer, but not larger than the number of players.
 - The stopping condition can be more than 1.

3 Collaborative Quantity

- Efficiency
 - the rate that labels are matched.
- Quality
 - the proportion of good labels among all matched labels.
- Utility
 - the throughput rate of good labels.
 - **Utility = Efficiency × Quality**

Assumption of Model

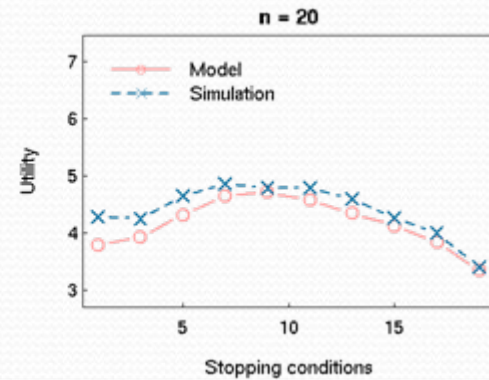
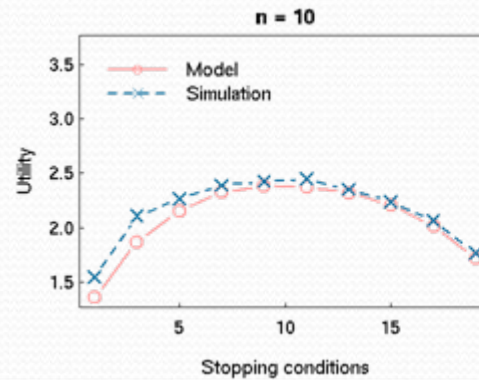
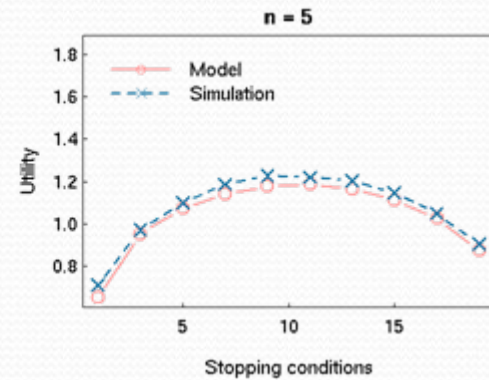
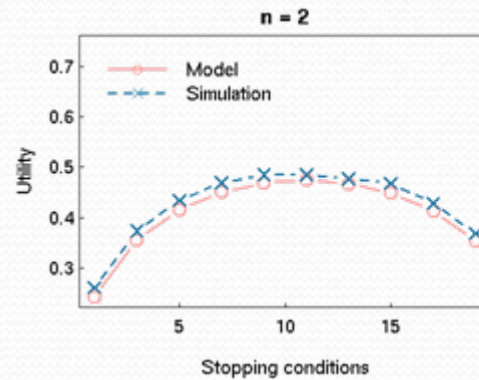
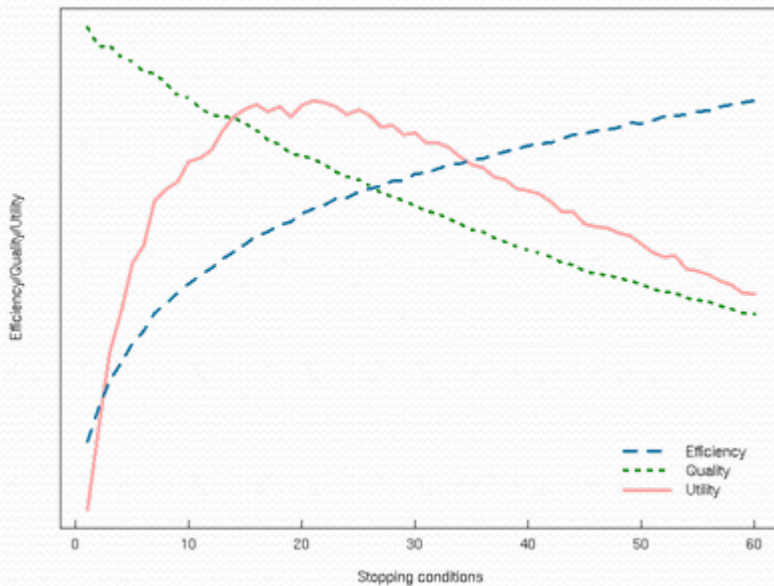
- Round-based play
 - Make only one guess in each round.
- Independent guess
 - Current guess is not affected by previous guesses.
- Good and bad words
 - The sizes of good and bad words are both limited.
 - Players will do their best to guess good words.
- Uniform guess
 - The guess is made uniformly.

Parameters in the Model

- Number of players
 - denoted as n .
- Consensus threshold
 - denoted as m .
- Size of good vocabulary
 - denoted as v_{good}
- Probability of guessing good words
 - denoted as $prob_{good}$
- **Stopping condition** is our main variable.

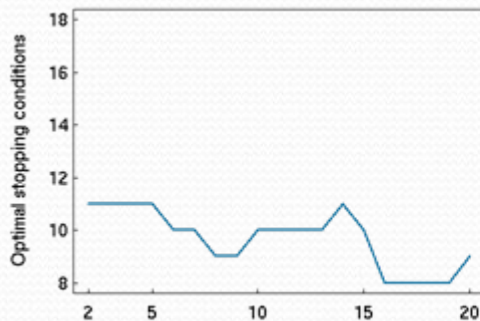
Model Validation

- **Trade-off** between efficiency & quality.
- Validate the model by simulations.

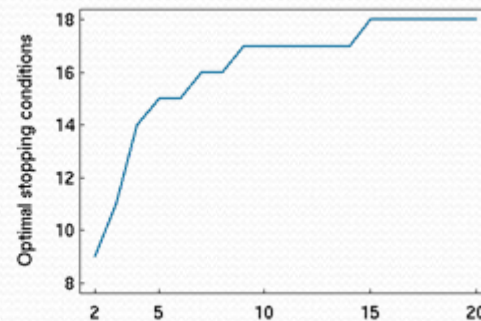


Optimal Stopping Conditions

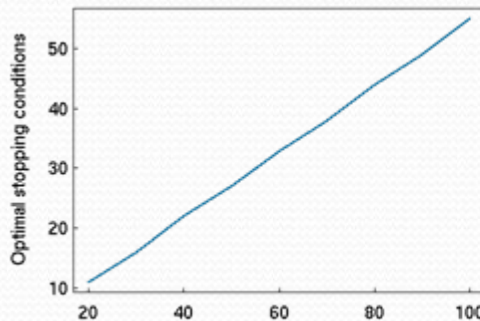
- Optimal stopping condition changes under different parameter settings.



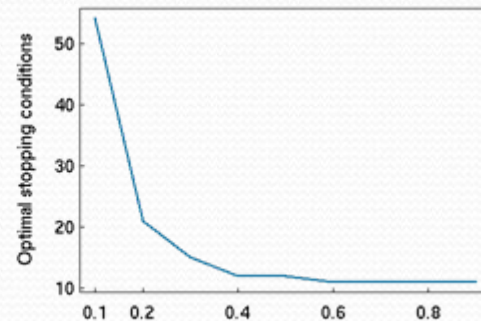
(a) Number of players



(b) Consensus threshold



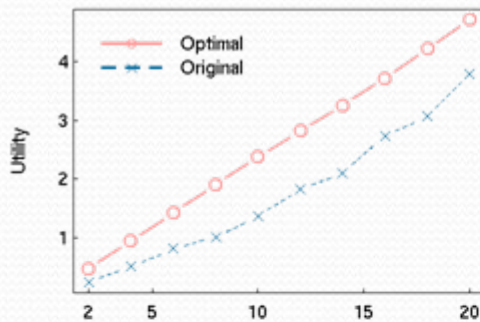
(c) Size of good vocabulary



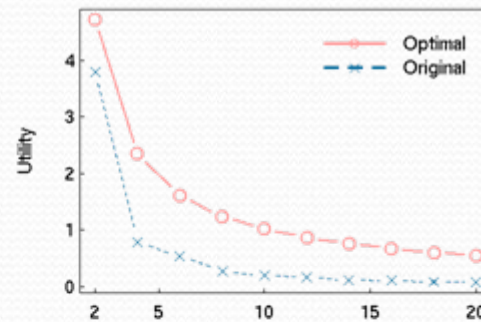
(d) Probability of choosing good words

Benefit of Optimization

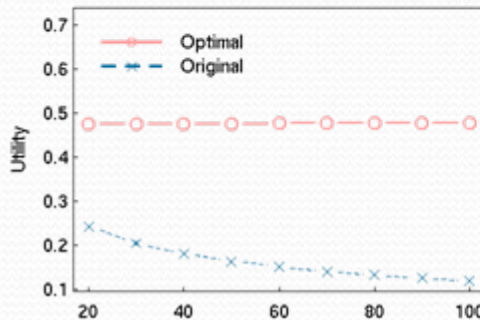
- We provide twice as much utility as a non-optimized game.



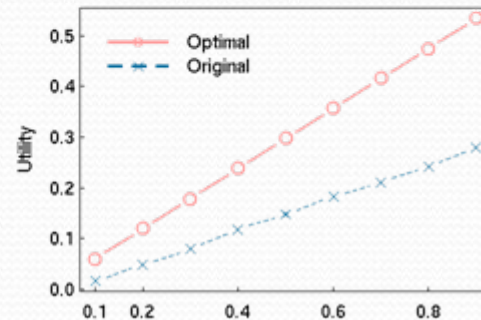
(a) Number of players



(b) Consensus threshold



(c) Size of good vocabulary



(d) Probability of choosing good words

Contribution

- Model for generalized games.
- Propose an optimal termination condition to optimize the system.
- Game providers can utilize our model to maximize the outcome of games.



Thank You!