

Sentiment-Enhanced Explanation of Product Recommendations

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Our Contribution

A novel explanation interface that particularly fuses the *feature sentiments* as extracted from reviews into explaining recommendations: *sentiment-enhanced organization interface*.

The top ranked camera according to your preferences



The other recommendations

They have better values at price, screen size, and better opinion at resolution, but worse value at weight.

They have better opinion at image quality, resolution, and better value at screen size, but worse value at weight.

They have better opinion at video quality, image quality, resolution, but worse value at weight.

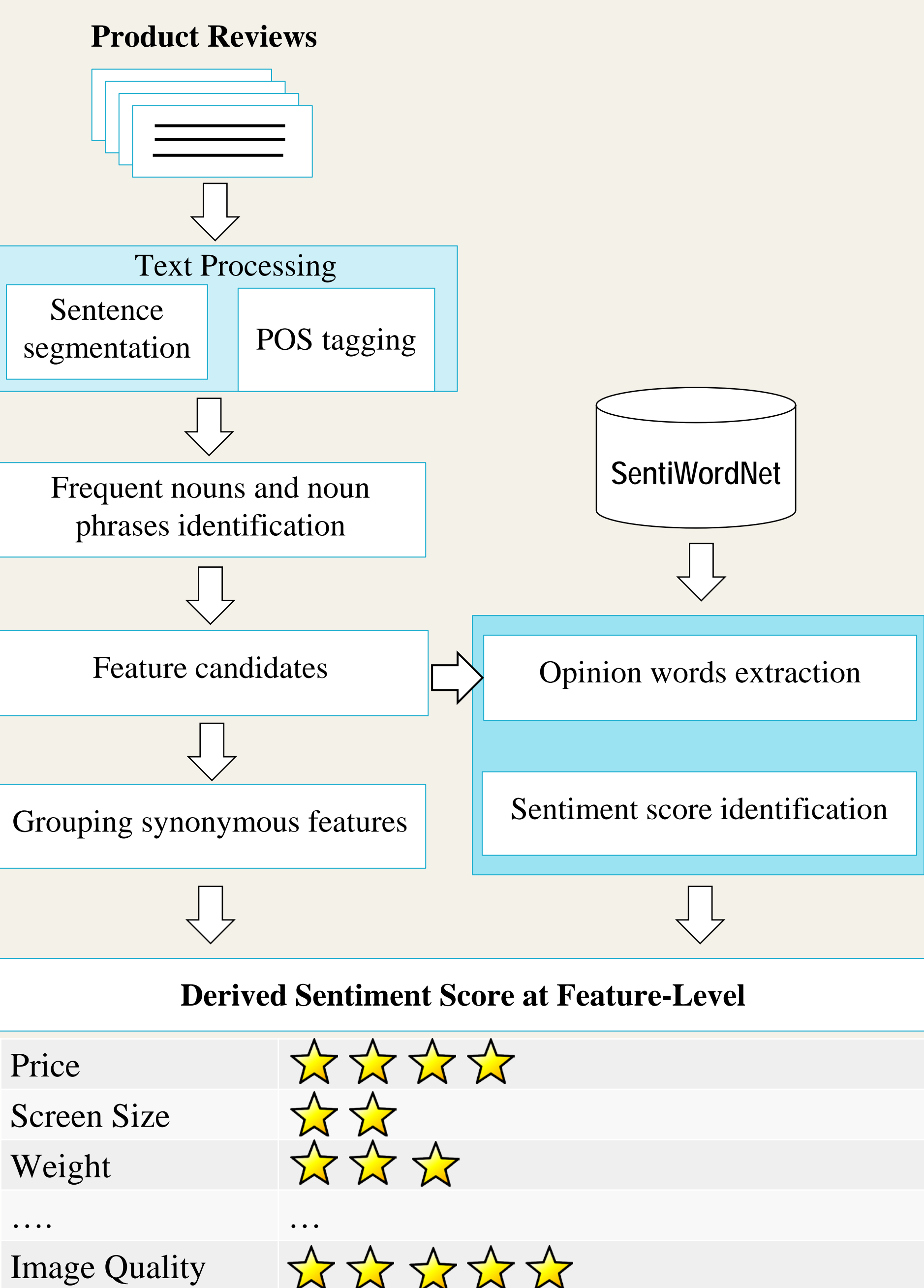
They have better opinion at video quality, resolution, and better value at optical zoom, but worse value at price.

The category title explains a group of similar products' properties in terms of both attributes' static values (e.g., "better value at screen size") and sentiments (e.g., "better opinion at resolution")

Design Guidelines [1]:

1. Each category title acts as the explanation, to show the pros and cons of the contained products against the top candidate;
2. Each category contains up to six products so as to avoid information overload;
3. The number of attributes accommodated in each explanation is controlled under five;
4. The explanations should be as diverse as possible since it is not informative to have two categories with similar titles.

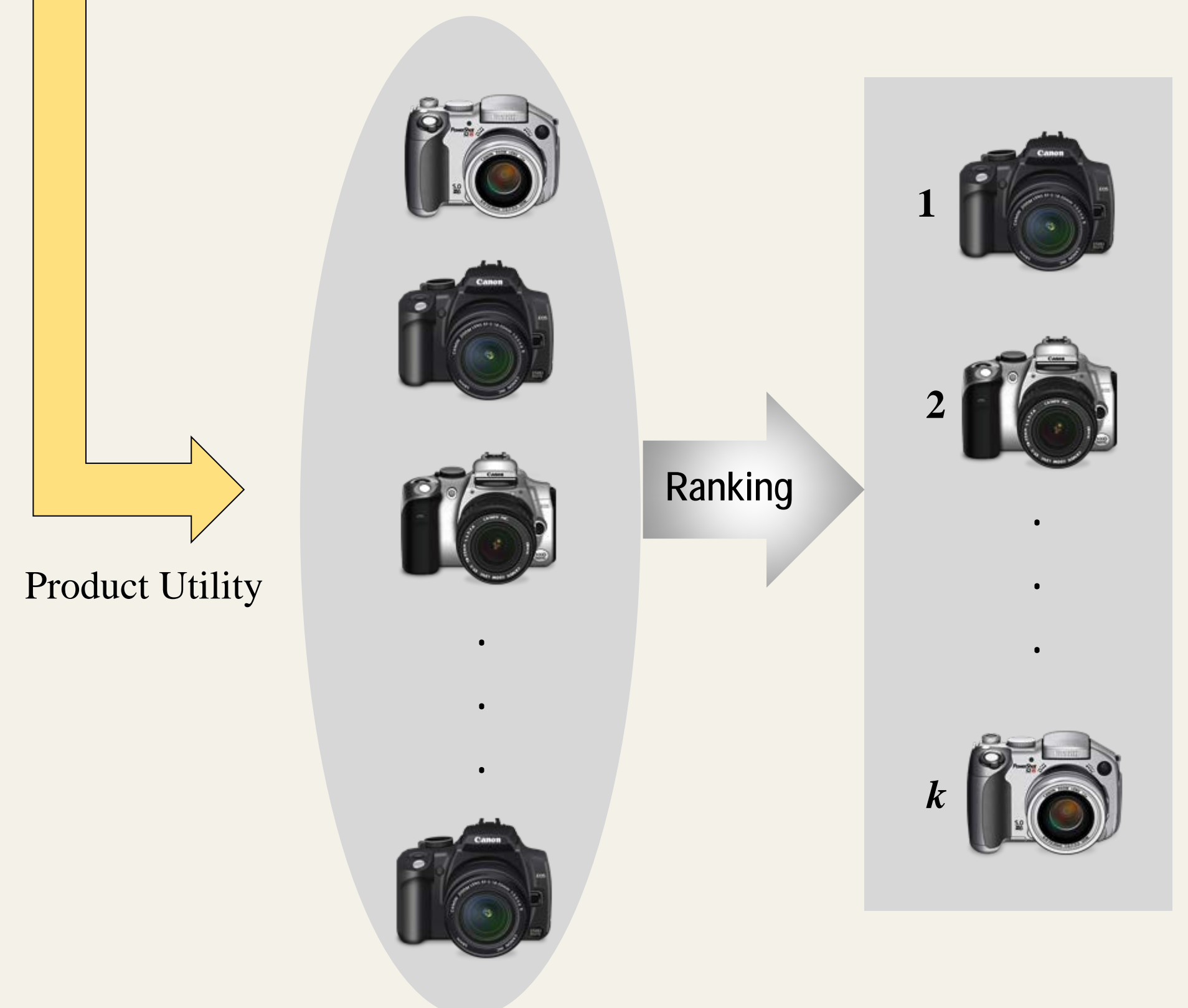
Step 1: Feature-based Sentient Analysis



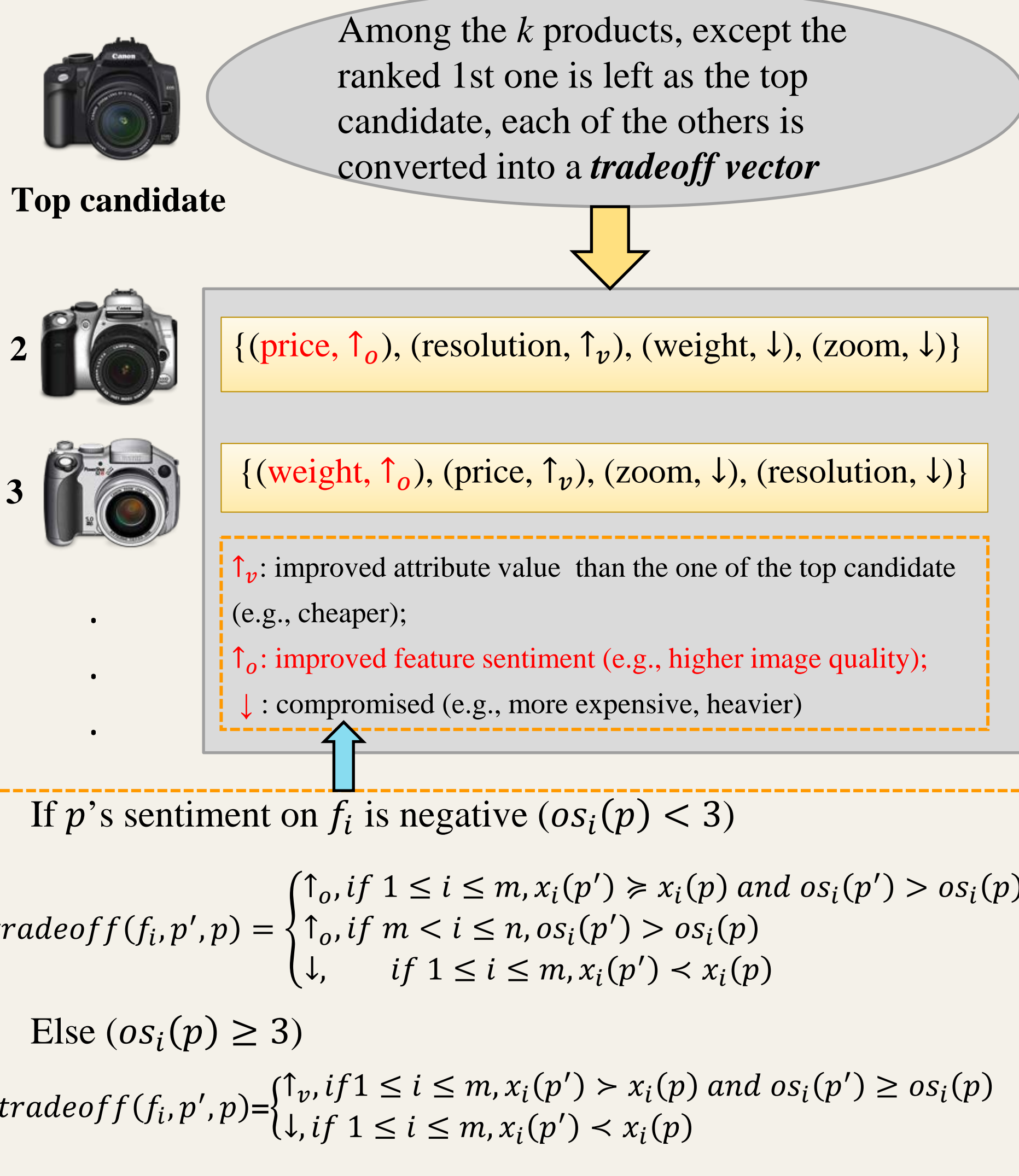
Step 2: Modeling of User Preferences

A weighted additive form of value functions, grounded on the Multi-Attribute Utility Theory [2]:

$$U(p) = \sum_{i=1}^m w_i * [\alpha * v_i(x_i(p)) + (1 - \alpha) * v_{senti}(os_i(p))] + \sum_{j=m+1}^n w_j * v_{senti}(os_j(p))$$



Step 3: Generation of Category Candidates



Association rule mining tool (Apriori algorithm) to discover the recurring and representative (*attribute, tradeoff*) patterns

The list of category candidates produced by the association rule mining tool

1. $\{(price, \downarrow), (screen\ size, \uparrow_o), (weight, \uparrow_p)\}$
2. $\{(price, \uparrow_p), (optical\ zoom, \downarrow), (resolution, \downarrow)\}$
3. $\{(price, \downarrow), (screen\ size, \uparrow_p), (ease\ of\ use, \uparrow_o), (resolution, \downarrow)\}$
4. $\{(price, \uparrow_o), (screen\ size, \downarrow), (weight, \downarrow), (image\ quality, \uparrow_o)\}$
5. $\{(screen\ size, \downarrow), (price, \downarrow), (optical\ zoom, \uparrow_p)\}$
6. $\{(weight, \downarrow), (price, \uparrow_o), (optical\ zoom, \uparrow_p)\}$
7. $\{(resolution, \downarrow), (optical\ zoom, \uparrow_o), (ease\ of\ use, \uparrow_o)\}$
8. $\{(price, \downarrow), (weight, \uparrow_p), (image\ quality, \uparrow_o)\}$
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Step 4: Selection of Categories

A large amount of category candidates produced by association rule mining tool

Favor categories with higher tradeoff utilities

$$TradeoffUtility(C) = \left(\sum_i |C| w_i \times tradeoff_i \right) \times \left(\frac{1}{|SR(C)|} \sum_{p \in SR(C)} U(p) \right)$$

Diversify categories including their contained products

$$Score(C) = TradeoffUtility(C) \times Diversity(C, SC)$$

Top candidate

Organized recommendations (in categories)

1. $\{(price, \uparrow_p), (screen\ size, \uparrow_p), (resolution, \uparrow_o), (weight, \downarrow)\}$
2. $\{(image\ quality, \uparrow_o), (resolution, \uparrow_o), (screen\ size, \uparrow_p), (price, \downarrow)\}$
3. $\{(video\ quality, \uparrow_o), (image\ quality, \uparrow_o), (resolution, \uparrow_o), (weight, \downarrow)\}$
4. $\{(video\ quality, \uparrow_o), (resolution, \uparrow_o), (optical\ zoom, \uparrow_p), (price, \downarrow)\}$

The top ranked camera according to your preferences

Senti-ORG

Hypotheses for User Evaluation

A prototype developed for two product domains: *digital camera* and *laptop*

| | Digital Camera | Laptop |
|---|----------------|--------|
| Number of products | 194 | 139 |
| Average number of static attributes per product | 6 | 7 |
| Average number of opinion features per product | 3 | 4 |

Hypotheses:

- Hypothesis 1:* the new interface (shorted as **Senti-ORG**) would be more *effective* than the original design (ORG [1]) in terms of aiding users to make accurate and confident decisions;
- Hypothesis 2:* Senti-ORG would be more *trustworthy* than ORG, so that users are more inclined to return to use it;
- Hypothesis 3:* Senti-ORG would be more *persuasive*, given that more users would be prepared to buy product chosen from it.

References

- [1] Chen, L. and Pu, P. 2010. Experiments on the Preference-based Organization Interface in Recommender Systems. In *TOCHI* 17, 1, 1-33.
- [2] Keeney, R. and Raiffa, H. 1976. *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*. Cambridge University Press.