PSYC 1340 / VLST 2110 Perception

Recitation 6 - Marr's Levels of Analysis

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Table of Contents

Marr's Levels Primer

> This assigned reading is important for HW 5

- Computational
  - What the goal of the process? What does it accomplish?
  - What? Why?
- Algorithm
  - What is the representation for the input and output, and what is the algorithm for the transformation?
  - How?
- Hardware/Implementation
  - How is the process physically realized?
  - How (physically)?

Marr Levels Practice

Consider a navigation app that uses crowd-sourced information to determine the “happiest” or “most scenic” routes (on foot, bike, public transportation, or car) between locations in Philadelphia. Consider the Marr levels as discussed in class and in the reading. For each description below, (1) state what Marr level you think the is being addressed and (2) explain with one sentence why you think that is the appropriate Marr level.

What level is this?

Find a route that routes the traveler past both Rittenhouse and Washington Square Parks.

Marr Levels Practice

Consider a navigation app that uses crowd-sourced information to determine the “happiest” or “most scenic” routes (on foot, bike, public transportation, or car) between locations in Philadelphia. Consider the Marr levels as discussed in class and in the reading. For each description below, (1) state what Marr level you think the is being addressed and (2) explain with one sentence why you think that is the appropriate Marr level.

What level is this?

Compute the intensity of the screen’s pixels and render the image on screen.

Marr Levels Practice

Consider a navigation app that uses crowd-sourced information to determine the “happiest” or “most scenic” routes (on foot, bike, public transportation, or car) between locations in Philadelphia. Consider the Marr levels as discussed in class and in the reading. For each description below, (1) state what Marr level you think the is being addressed and (2) explain with one sentence why you think that is the appropriate Marr level.

What level is this?

Route the relevant calculations to the phone’s central processing unit.

Marr Levels Practice

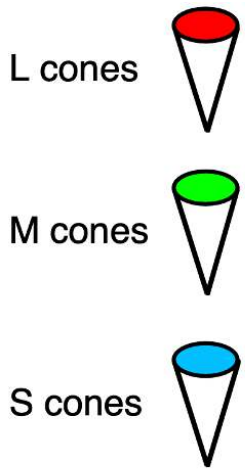
Consider a navigation app that uses crowd-sourced information to determine the “happiest” or “most scenic” routes (on foot, bike, public transportation, or car) between locations in Philadelphia. Consider the Marr levels as discussed in class and in the reading. For each description below, (1) state what Marr level you think the is being addressed and (2) explain with one sentence why you think that is the appropriate Marr level.

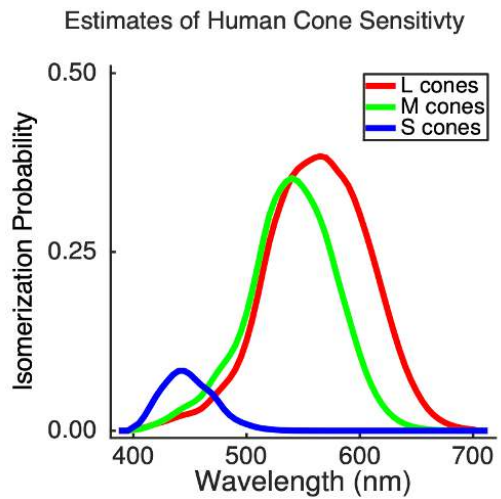
What level is this?

Given basic information inputted by the engineers and additional information (pictures, anecdotes, other details) provided by users, find the top 3 most scenic paths between two locations by optimizing route duration and the number of interesting landmarks along the route.

Computing number of cone photopigment molecules isomerized

To compute the number of cone photopigment molecules isomerized by a light for each cone type we take the number of photons (aka quanta) in the light at each wavelength, multiply by the corresponding sensitivity for the type of interest, and then sum over wavelengths.





Isomerization Strategy

$$\sum_{i=1}^{n} s_i \cdot p_i$$

$s =$ sensitivity

$p =$ number of photons/quanta

$i =$ wavelength

To compute the number of cone photopigment molecules isomerized by a light for each cone type, we take the number of photons (aka quanta) in the light at each wavelength, multiply by the corresponding sensitivity for the type of interest, and then sum over wavelengths.

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

a) Compute the number of isomerizations for the S cones to a light that consists of the mixture of 1000 photons at 420 nm, 500 photons at 500 nm, and 1000 photons at 540 nm.

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

b) Consider an observer who has only S cones. Find the number of quanta that would be needed in a light of 460 nm for this light to match the light described in a), for this observer. Round your answer to the nearest integer.

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

c) Compute the number of isomerizations that the light de-scribed in a) will produce in the L cones. Also compute the number of isomerizations that the light you found in b) will produce in the L cones. Round your answer to the nearest integer.

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

d) Will the two lights from a) and b) match for an observer who has both L cones and S cones, but not M cones? Why or why not?

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

e) Compute the responses of the L cones and the S cones to a light consisting of the mixture of 772 quanta at 460 nm and 1203 quanta at 600 nm. Round your answer to the nearest integer.

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Isomerization Practice

$$\sum_{i=1}^{n} s_i \cdot p_i$$

f) Will the light from e) match the light from a) for an observer with L cones and S cones, but not M cones?

Wavelength (nm)	L Cone	S Cone
400	0.00	0.06
420	0.02	0.54
440	0.04	0.99
460	0.06	0.79
480	0.14	0.39
500	0.29	0.12
520	0.63	0.03
540	0.88	0.01
560	0.98	0.00
580	0.97	0.00
600	0.83	0.00
620	0.55	0.00
640	0.27	0.00
660	0.09	0.00
680	0.03	0.00
700	0.01	0.00

Movie Time

See you next week!