

Expanding the Point Automatic Enlargement of Presentation Video Elements

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PROBLEM STATEMENT

Many lecture videos are becoming available online and mobile learning is becoming more popular. We propose a method of enhancing lecture videos on mobile devices by magnifying relevant information.

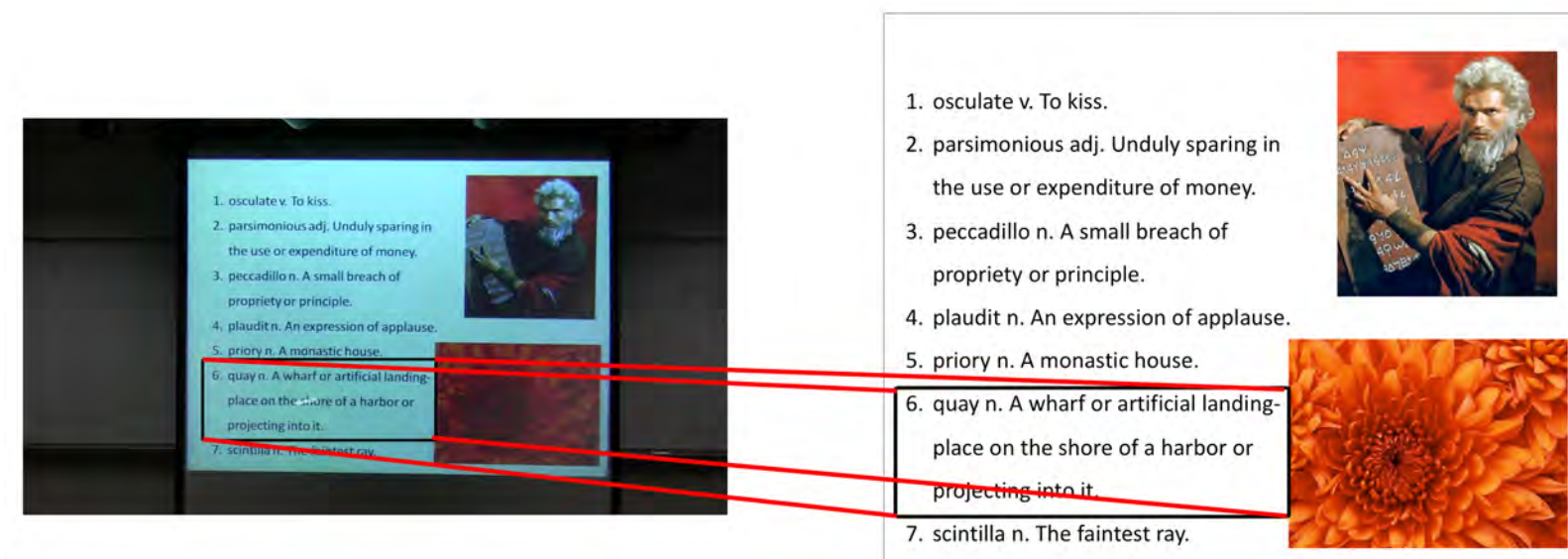
CONTRIBUTIONS

- Identification of **semantic units**.
- Identification of laser gestures.
- Magnification of semantic units
 - When highlighted by laser gestures.
 - When text in a slide is read.

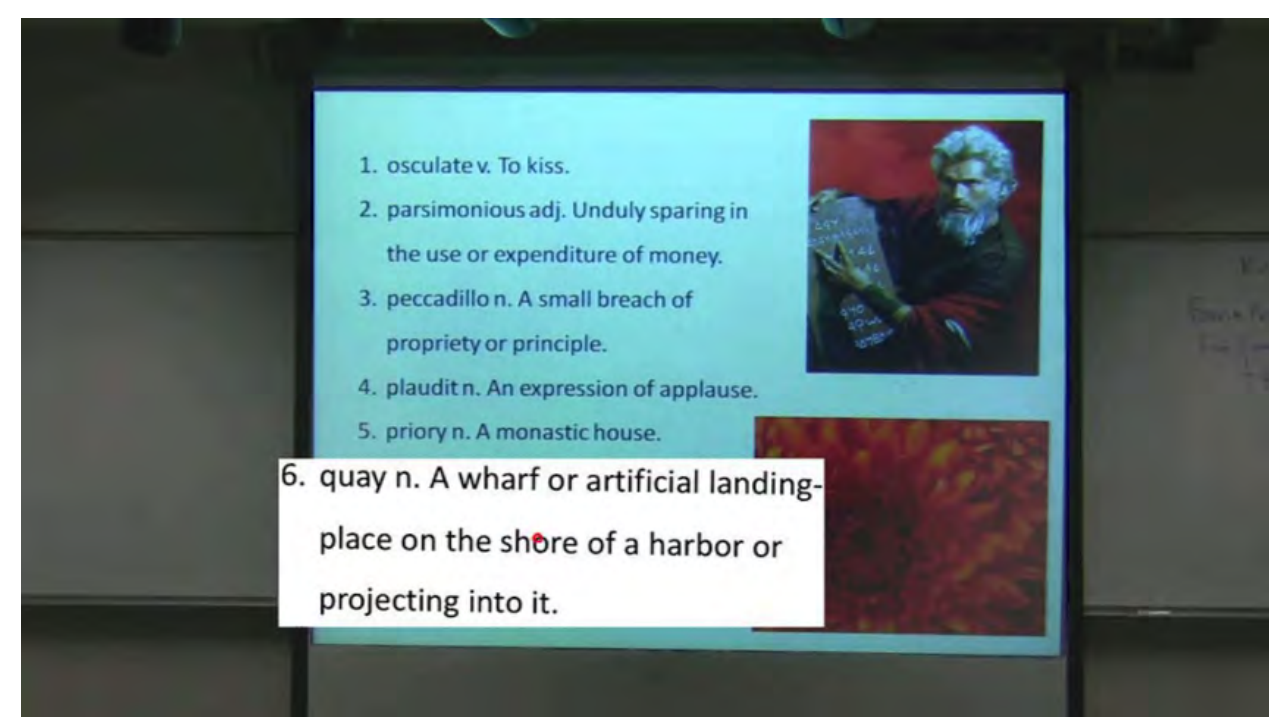
GLOSSARY

1. **Homography**: a projective transformation that relates two planar surfaces as seen by a pinhole camera.
2. **Semantic unit**: an image or text (a phrase or just a word).

MAGNIFICATION



Here, we find the homography for a semantic unit.



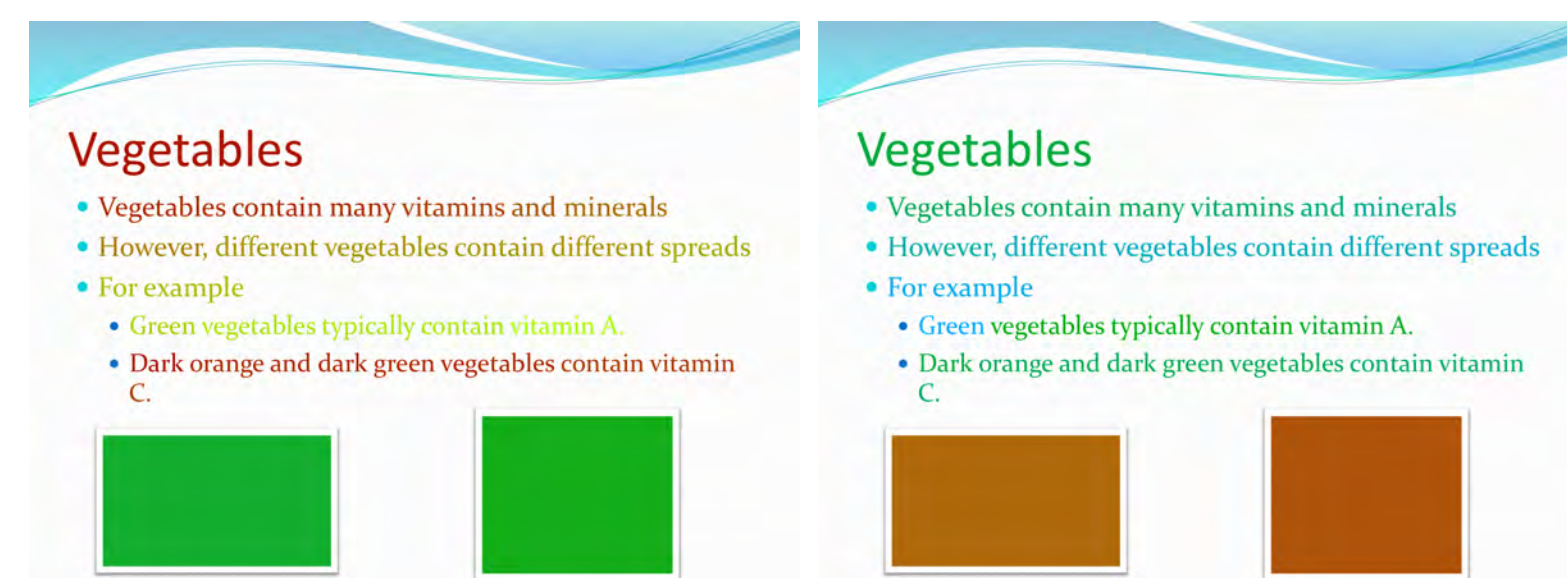
Magnify and align semantic unit.

1. Obtain homography using methods from [1]
2. Enlarge and center homography.
3. Backproject part of slide's image into frame.

FINDING SEMANTIC UNITS



Original slide image



Two slides with uniquely colored semantic units.

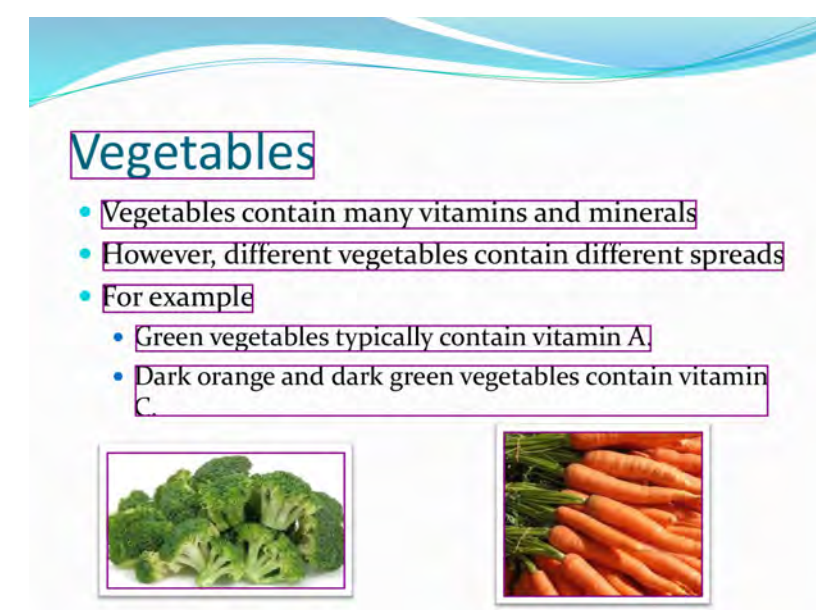


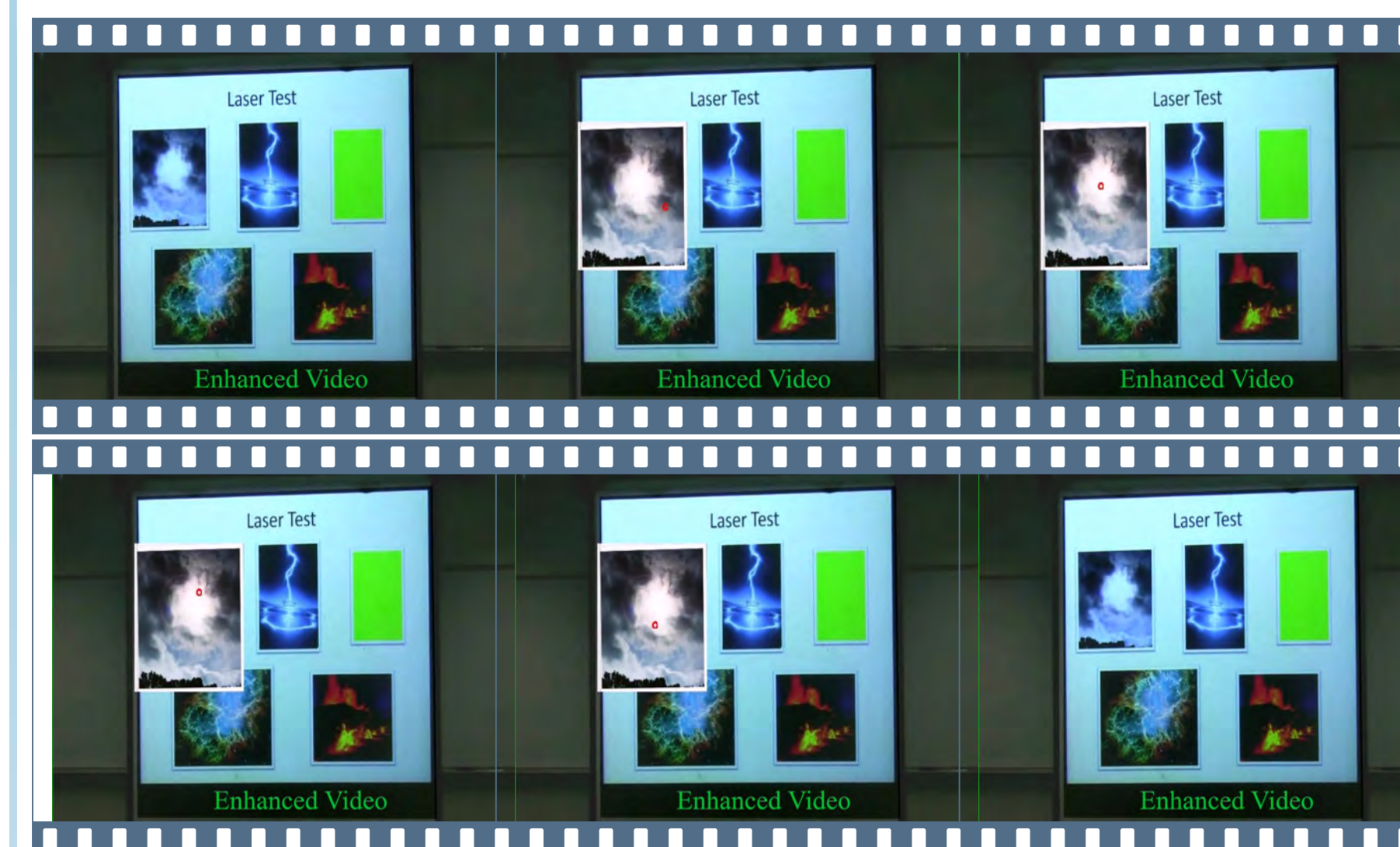
Image with bounding boxes

1. Parse PowerPoint file for words and images (semantic units).
2. For each semantic unit, change to a unique color.
3. Apply this to two copies of a slide.
4. For each slide, compare resulting images.
5. Find min and max coordinates of difference for each semantic unit.
6. Create bounding box.

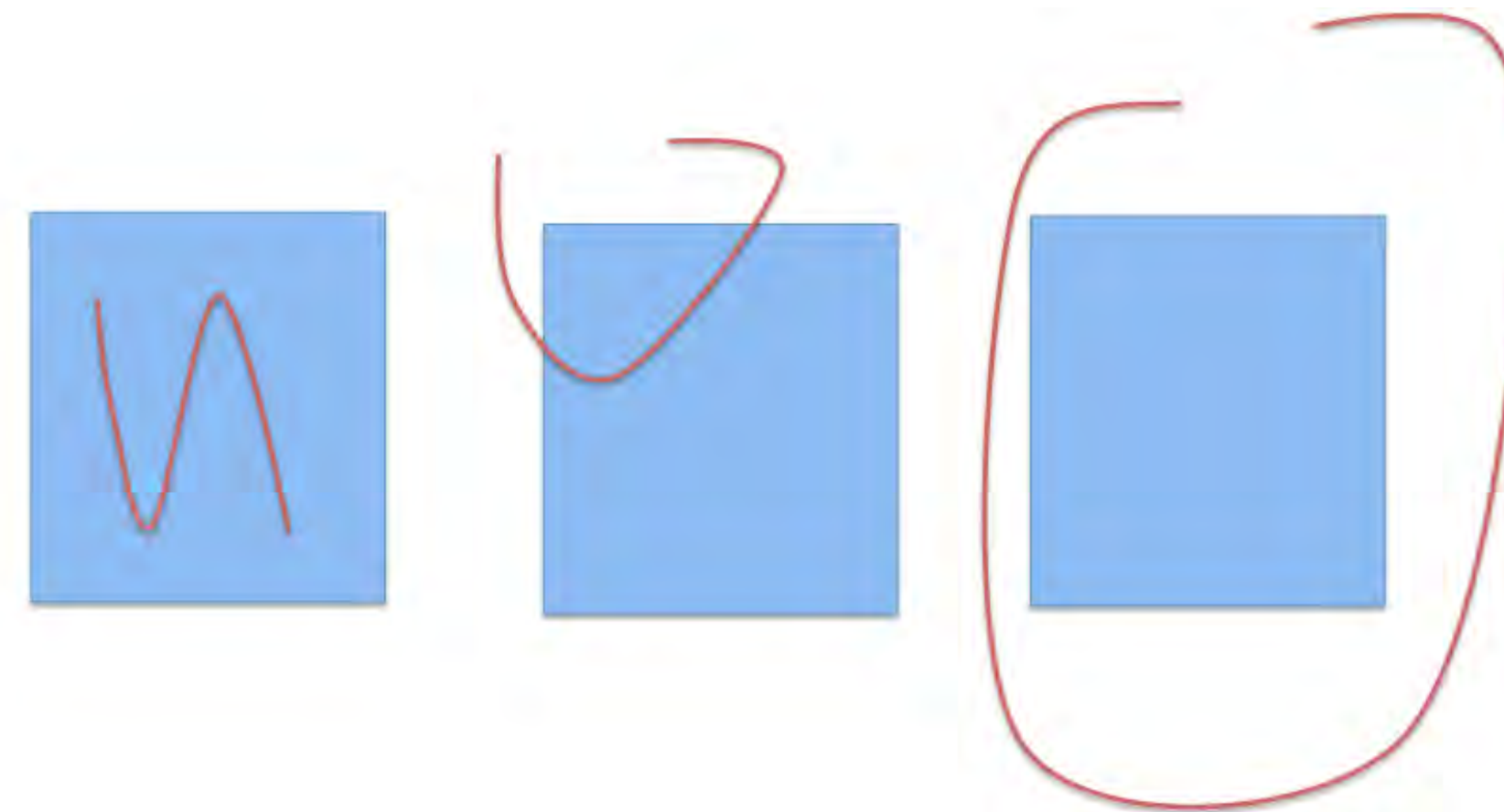
CLASSROOM ACTIVITIES

1. In Algebra 2, systems of equations were interpreted as a method of solving the problem of curve intersection.
2. Calculus students studied the concept of fitting lines to noisy data with linear regression.

LASER GESTURE EVENTS

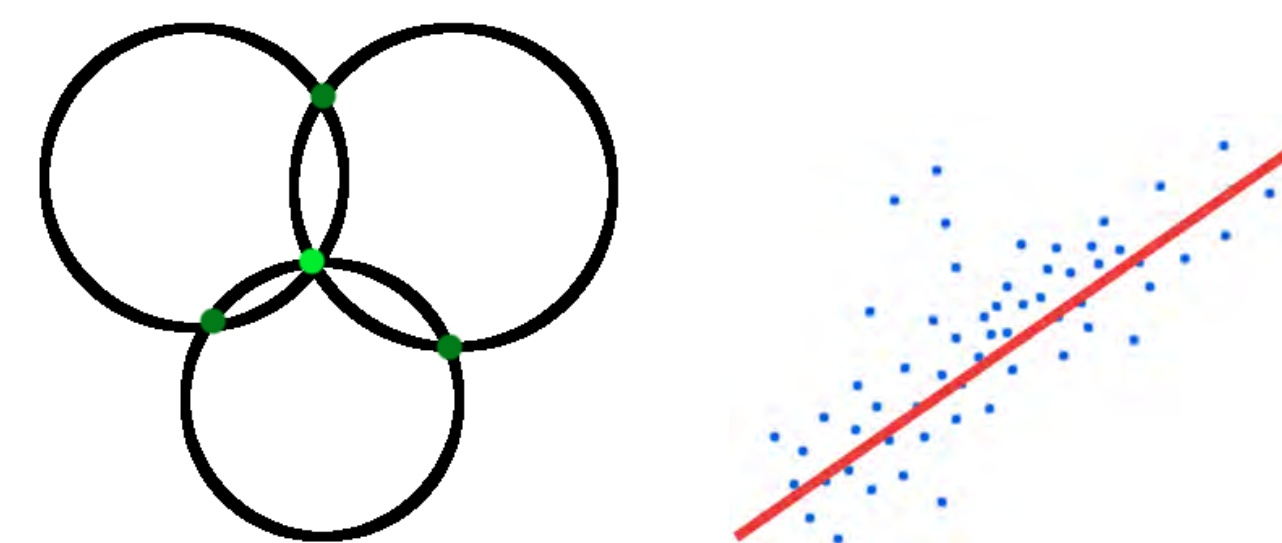


3. **abut v. To touch at the end or boundary line**
4. **consanguineous adj. Descended from the same parent or ancestor**
5. **gibe v. To utter taunts or reproaches**
6. **guileless adj. Frank**
7. **gynococracy n. Female supremacy**
8. **monibund adj. On the point of dying**



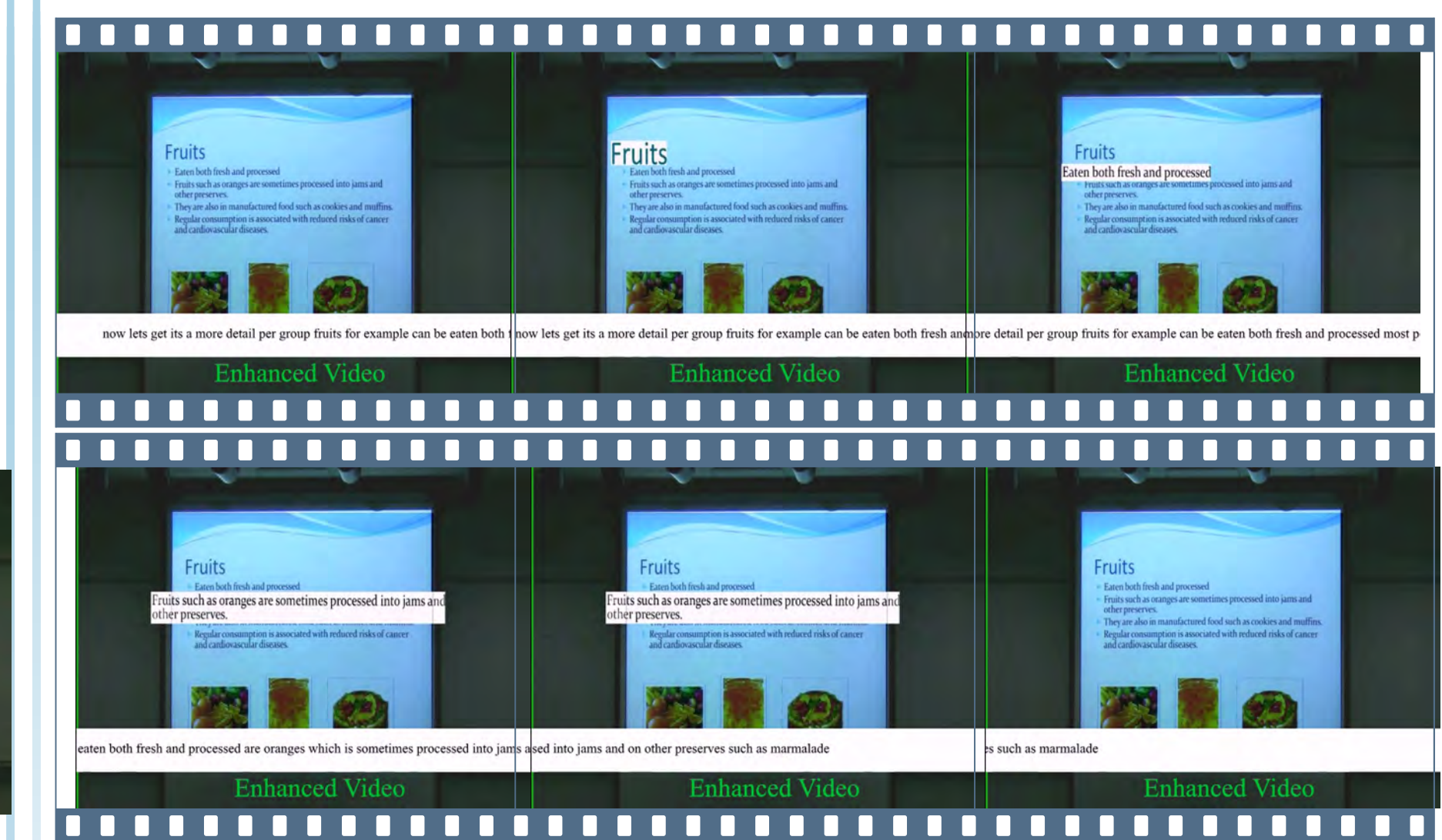
Finding gestures

1. Find laser point in each frame.
2. Create line segments from every pair of point.
3. Count number of intersections between line segments and every semantic unit's bounding box.
4. Semantic unit with most intersections will be magnified.



Solving systems of equations and fitting lines.

SPEECH EVENTS



1. Use automated speech recognition system to obtain transcript.
2. Align transcript words to slide words, as in [2].
3. Find time stamps for all words in a single text bullet.
4. Magnify text bullet for the duration that it is read.

RESULTS

Speech Boundary Error

	Precision	Recall
Talk 1	0.290	0.375
Talk 2	0.369	0.409
Talk 3	0.317	0.343
Average	0.320	0.376

- Not all words related to bullet are spoken.
- Only using slide words limited.

User Study

	w/o mag	mag
Correct	74	86
Incorrect	87	33
Score	0.460	0.723

- Tests how much viewers remember lecture content.
- Significant difference: t-test with p -value < 0.05 .

REFERENCES

- [1] Q. Fan, K. Barnard, A. Amir, A. Efrat Accurate alignment of presentation slides with educational video In *ICME '09*
- [2] R. Swaminathan, M. E. Thompson, S. Fong, A. Efrat, A. Amir, K. Barnard Improving and Aligning Speech with Presentation Slides In *ICPR '10*