

assisting the diagnosis of developmental disorder by applying this technique, or the like, are proposed.

~~Citation List~~

~~Patent Literature~~

- 5 ~~[0004] — Patent Literature 1: Japanese Patent Application Laid-open No. 2011-206542 A1~~

~~Patent Literature 2: Japanese Patent Application Laid-open No. 2005-198743 A1~~

~~Non-Patent Literature~~

- 10 ~~[0005] — Non-Patent Literature 1: Pierce K et al., —  
"Preference for Geometric Patterns Early in Life as a Risk-  
Factor for Autism.", Arch Gen Psychiatry. 2011 Jan; 68(1):  
101-109.~~

~~Summary~~

- 15 [0006] As described above, even with known techniques for detecting a gaze point and techniques for assisting diagnosis of a subject with developmental disorder, there are further demands for a method for detecting with higher accuracy.

- 20 [0007] In view of the above, it is an object of the present invention to provide a detection apparatus and a detection method capable of achieving improved detection accuracy.

- [0008] In one aspect, there is provided a detection  
25 apparatus comprising:

- a display;
- an imaging unit configured to image a subject;
- an eye gaze detector configured to detect an eye gaze direction of the subject based on a captured image captured  
30 by the imaging unit;
- an output controller configured to display a diagnostic image that includes a person image and a geometric pattern image, onto the display; and

## CLAIMS

1. A detection apparatus comprising:
  - a display;
  - an imaging unit configured to image a subject;
  - 5 an eye gaze detector configured to detect an eye gaze direction of the subject based on a captured image captured by the imaging unit;
  - an output controller configured to display a diagnostic image that includes a person image and a
  - 10 geometric pattern image, onto the display; and
  - a gaze point detector configured to detect a first gaze point as a gaze point of the subject in the person image based on the eye gaze direction, and configured to detect a second gaze point as a gaze point of the subject
  - 15 in a region that includes at least one of a center of a geometric pattern, a characteristic portion of the geometric pattern, a portion in which density of lines forming the geometric pattern is higher than other portions, and a portion in which the geometric pattern
  - 20 changes, in the geometric pattern image.
2. The detection apparatus according to claim 1,
  - wherein the gaze point detector detects the first gaze point as the gaze point of the subject in a region that
  - 25 includes a face in the person image.
3. The detection apparatus according to claim 1 or 2,
  - further comprising an evaluator configured to calculate an evaluation value of the subject based on the first gaze
  - 30 point and the second gaze point.
4. The detection apparatus according to claim 3,
  - ~~wherein the evaluator calculates an evaluation value~~

of the subject based on at least one of a ratio of a count value of the first gaze point to a count value of the second gaze point, a ratio of the count value of the second gaze point to the count value of the first gaze point, a  
5 ratio of the count value of the first gaze point to count values of all gaze points used in evaluation, and a ratio the count value of the second gaze point to the count values of all the gaze points used in evaluation.

10 5. The detection apparatus according to claim 1, further comprising:

an illuminator that includes a light source to emit light;

15 a first calculator configured to calculate a first position representing a pupil center based on an image of an eyeball of a subject, the image being captured by the imaging unit with light being emitted from the illuminator;

a second calculator configured to calculate a second position representing a corneal reflection center based on  
20 the captured image of the eyeball; and

a third calculator configured to calculate a third position representing a corneal curvature center based on a line that connects the light source with the second position,

25 wherein the eye gaze detector detects an eye gaze of the subject based on the first position and the third position.

6. A detection apparatus comprising:

30 a display;

an imaging unit configured to image a subject;

an eye gaze detector configured to detect an eye gaze  
~~direction of the subject based on a captured image captured~~

by the imaging unit;

an output controller configured to display a diagnostic image that includes a person image including a face, and a geometric pattern image, onto the display; and

5 a gaze point detector configured to detect a first gaze point as a gaze point of the subject, in a region that includes a face in the person image, based on the eye gaze direction, and configured to detect a second gaze point as a gaze point of the subject, in the geometric pattern  
10 image.

7. A detection method comprising:

an eye gaze detection step of detecting an eye gaze direction of a subject based on a captured image captured  
15 by an imaging unit configured to image the subject;

an output control step of displaying a diagnostic image that includes a person image and a geometric pattern image, onto a display; and

a gaze point detection step of detecting a first gaze  
20 point as a gaze point of the subject in the person image based on the eye gaze direction, and to detect a second gaze point as a gaze point of the subject in a region that includes at least one of a center of a geometric pattern, a characteristic portion of the geometric pattern, a portion  
25 in which density of lines forming the geometric pattern is higher than other portions, and a portion in which the  
~~geometric pattern changes, in the geometric pattern image.~~

## CLAIMS

1. A detection apparatus comprising:
  - a display;
  - an imaging unit configured to image a subject;
  - an eye gaze detector configured to detect an eye gaze direction of the subject based on a captured image captured by the imaging unit;
  - an output controller configured to display a diagnostic image that includes a person image and a geometric pattern image, onto the display; and
  - a gaze point detector configured to detect a first gaze point as a gaze point of the subject in the person image based on the eye gaze direction, and configured to detect a second gaze point as a gaze point of the subject in a region that includes at least one of a center of a geometric pattern, a characteristic portion of the geometric pattern, a portion in which density of lines forming the geometric pattern is higher than other portions, and a portion in which the geometric pattern changes, in the geometric pattern image.
2. The detection apparatus according to claim 1,
  - wherein the gaze point detector detects the first gaze point as the gaze point of the subject in a region that includes a face in the person image.

3. The detection apparatus according to claim 1 or 2, further comprising an evaluator configured to calculate an evaluation value of the subject based on the first gaze point and the second gaze point.

4. The detection apparatus according to claim 3,  
wherein the evaluator calculates an evaluation value of the subject based on at least one of a ratio of a count value of the first gaze point to a count value of the second gaze point, a ratio of the count value of the second gaze point to the count value of the first gaze point, a ratio of the count value of the first gaze point to count values of all gaze points used in evaluation, and a ratio the count value of the second gaze point to the count values of all the gaze points used in evaluation.

5. The detection apparatus according to claim 1, further comprising:  
an illuminator that includes a light source to emit light;  
a first calculator configured to calculate a first position representing a pupil center based on an image of an eyeball of a subject, the image being captured by the imaging unit with light being emitted from the illuminator;

a second calculator configured to calculate a second position representing a corneal reflection center based on the captured image of the eyeball; and

a third calculator configured to calculate a third position representing a corneal curvature center based on a line that connects the light source with the second position,

wherein the eye gaze detector detects an eye gaze of the subject based on the first position and the third position.

6. A detection method comprising:

an eye gaze detection step of detecting an eye gaze direction of a subject based on a captured image captured by an imaging unit (102) configured to image the subject;

an output control step of displaying a diagnostic image that includes a person image and a geometric pattern image, onto a display (101); and

a gaze point detection step of detecting a first gaze point as a gaze point of the subject in the person image based on the eye gaze direction, and to detect a second gaze point as a gaze point of the subject in a region that includes at least one of a center of a geometric pattern, a characteristic portion of the geometric pattern, a portion in which density of lines forming the geometric pattern is higher than other portions, and a portion in which the geometric pattern changes, in the geometric pattern image.