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[Continued on next page]

(54) Title: IMAGE ANALYSIS FOR DETERMINING CHARACTERISTICS OF ANIMAL AND HUMANS

Facial Descriptor Name: Degree of Facial InflexionAnatomical Region of Face: AR01_FacialProfileGeneral Description:

Describes the degree of structural concavity/convexity of the *True Line of the face*. Differentiate between a concave "dished", convex "roman", or straight bone structure.

Mathematical Proof:

$$\overline{AB} = \sqrt{(B_x - A_x)^2 + (B_y - A_y)^2}$$

$$\overline{AC} = \sqrt{(C_x - A_x)^2 + (C_y - A_y)^2}$$

$$\overline{BC} = \sqrt{(C_x - B_x)^2 + (C_y - B_y)^2}$$

finds distance values for all sides of triangle

$$\theta = \cos^{-1} \left(\frac{\overline{BC}^2 - \overline{AB}^2 - \overline{AC}^2}{-2 * \overline{AB} * \overline{AC}} \right)$$

finds the angle for $\angle BAC$, denoted here as θ

$$d = \sin(\theta) * \overline{AC}$$

finds the height of triangle $\triangle ABC$, the distance of facial inflexion

$$M_{ab} = \frac{(A_y - B_y)}{(A_x - B_x)}$$

finds the slope of line $\overline{AB}$

$$Q_x = \left(\frac{C_y - A_y}{M_{ab}} \right) + A_x$$

finds the x-coordinate of point Q intersected by line $\overline{AB}$ and its horizontal bisector inclusive of point C

$$a = Q_x - C_x$$

finds a value for which a is either positive or negative, indicating respectively either convexity or concavity by the location of point C relative to the position of point Q on the Profile Line of the face

$$\sigma = \frac{a}{|a|}$$

finds σ , here defined as the Constant of Concavity with magnitude 1 indicating direction of inflexion via sign (+)

$$DaFI = \sigma * \left(\frac{d}{\overline{AB}} \right)$$

finds the **Degree of Facial Inflexion**, here defined as the degree of perpendicular deviation of the Upper Profile of the skull from the *True Line of the Face* relative to the overall length of the face.

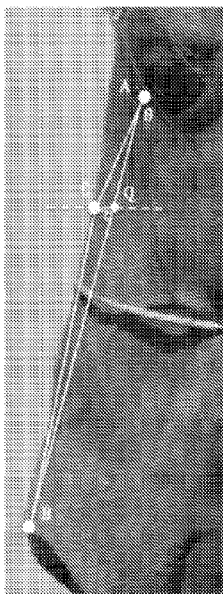


Fig. 1A

(57) **Abstract:** Systems and methods are disclosed for predicting one or more characteristics of an animal by applying computational methods to image(s) of the animal to generate one or more metrics indicative of the characteristics. Embodiments determine predictors of characteristics by creating a sample library of animals of a particular type, determining facial descriptor measurements for each animal, determining relationships between facial descriptor measurements and additional library data, and selecting predictors from these

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DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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relationships. Other embodiments predict characteristics of animals not in the library and, optionally, categorize animals for particular discipline, training, management, care, etc. based on the characteristics. Other embodiments predict characteristics and determine strategies for group(s) of animals using predicted characteristics of individual animals. Embodiments are broadly applicable to domesticated animals including dogs, cats, cattle, oxen, llamas, sheep, goats, camels, geese, horses, chickens, turkeys, and pigs. Other embodiments predict certain characteristics of humans, including certain cognitive or developmental disorders.

A. CLASSIFICATION OF SUBJECT MATTER**G06T 7/00(2006.01)i, G06F 19/00(2011.01)i, G06F 17/10(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06T 7/00; A01K 1/00; A01K 29/00; G06K 9/46; G06K 9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: digital image, individual animal, reference point, metric, predict, characteristic, and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005-0011466 A1 (JOHN CONAN DOYLE II) 20 January 2005 See paragraphs [0027]-[0076]; claims 1-46 and figures 1-5.	1-65
A	US 2007-0110281 A1 (SCOTT JURK) 17 May 2007 See paragraphs [0029]-[0061]; claims 1-24 and figures 1-18.	1-65
A	US 2004-0208343 A1 (BRUCE L. GOLDEN et al.) 21 October 2004 See paragraphs [0028]-[0057]; claims 1-31 and figures 1-10.	1-65
A	US 2007-0127781 A1 (DANIEL E. STEWART) 07 June 2007 See paragraphs [0013]-[0052]; claims 1-25 and figures 1-9.	1-65
A	US 2010-0224140 A1 (TAL BAREKET et al.) 09 September 2010 See paragraphs [0104]-[0112]; claims 1-27 and figures 1-3.	1-65



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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