Reference

[1] Cardillo, J. and Sid-Ahmed, M. A., "An Image Processing System for the Automatic Extraction of Craniofacial Landmarks," IEEE Trans. In Medical Imaging, vol. 13(2), pp.275–289, June 1994.

[2] Chen, Y., Cheng, K. and Liu, J. "Improving cephalogram analysis through feature subimage extraction," IEEE Eng. Med. Biol. Mag. Vol.18, pp. 25-31, 1999.

[3] Chakrabartty, S., Yagi, M., Shibata, T. and Gawenberghs, G. "Robust cephalometric landmark identification using support vector machines," in Proc. Int. Conf. Multinedia and Expo, pp. 429-432, 2003.

[4] Ciesielski, V., Innes, A., John, S., and Mamutil, J. "Genetic programming for Landmark Detection in Cephalometric Radiologt Images".

[5] Davis and Taylor "Knowledge-Based Cephalometric analysis: A Comparison with Clinicians using interactive Computer methods," *Computer biomedical Research,* vol. 27(3), pp. 210–228, June 1994.

[6] Davis, D. and Douglas Forsyth "Knowledge-Based Cephalometric analysis: A Comparison with Clinicians using interactive Computer methods," *Computer biomedical Research,* vol. 27(3), pp. 210–228, June 1994.

[7] Digital Image Processing using MATLAB by Rafael C. Gonzales, Richard E. Woods, Sreven L. Eddins.

[8] Ei-Feghi and Vassy, Z. "A Simplified and Fast Version of the Hueckel Operator for Finding Optimal Edges in Pictures," in Proc. 14th International Joint Conference on Artificial Intelligence, 1975, pp. 650–655.

[9] Forsyth, D. B. and Davis, D. N. "Assessment of an Automated Cephalometric Analysis System," *European Journal of Orthodontists*, vol. 18(5), pp. 471–478, Oct. 1996.

[10] Fuzzy Logic Intelligence, Control and Information by John Yen, Reza Langari.

[11] Grau, V., Juan, M. C., Monserrat, C. and Knoll, C. "Automatic Localization of Cephalometric Landmarks, "Journal of biomedical information vol.34 pp. 146–156, Sept. 2001.

[12] Hutton, T.J., Cunningham, S. and Hammond, P. "An evaluation of active shape models for the automatic identification of cephalometric landmarks," The European Journal of Orthodontics, vol. 22(5), pp. 499–508, Oct. 2000.

[13] Innes, A., Ciesielski, V., Mamutil, J. and John, S. "Landmark detection for cephalometric radiology images using pulse coupled neural networks," Int. Conf. in computing in communication, pp. 391-396,2002.

[14] Kafieh, R., Mehri, A., and Sadri, S. Automatic Landmark Detection in Cephalometry Using a Modified Active shape Model with Sub Image Matching.

[15] Levy-Mandel, A.D., Venetsamopolus, A.N., Tsosos, J. K. Knowledge based landmarking of cephalograms. Computers and Biomedical Research 1986; 19: 282-309.

[16] Leonardi, R., Giordano, D., and Maiorana, F. An Evolution of Cellular Neural Networks for the Automatic.

[17] Mero, L. and Vassy, Z. "A Simplified and Fast Version of the Hueckel Operator for Finding Optimal Edges in Pictures," in Proc. 14th International Joint Conference on Artificial Intelligence, 1975, pp. 650–655.

[18] Parthasaraty, S., Nugent, S., Gregson, P., Georgen, P. G. and Fay, D.F. "Automatic Landmarking of ephalograms, "Computer and biomedical research, vol. 22(3), pp. 248– 269, June 1989.

[19] Rahele Kafieh, Alireza mehri Automatic landmark detection in cephalometry using a modified Active Shaoe Model with Sub Image Matching.

[20] Rudolph, D. J, Sinclair, P. M. Coggins, J. M, "Automatic Computerized Radiographic Identification of Cephalometric Landmarks," American Journal of Orthodontics and Dentfacial Orthopedics, vol. 113, pp. 173–179, Feb. 1998.

[21] Saad, Chen, Y., Cheng, K. Accuracy of computerized automatic identification of cephalometric landmarks. Am J Orthod Dentofacial Orthop 2000; 118: 535-540.

[22] Tong, W., Nugent, S. T., Gregson, P. H., Jensen, G. M. and Fay, D. F. "Landmarking of Cephalograms Using a Microcomputer System," *Computer and Biomedical Research*, vol. 23(4), pp. 358–379, Aug. 1990.

[23] Uchino, E. and Yamakawa, T. "High speed fuzzy learning machine with guarantee of global minimum and its application to chaotic system identification and medical image processing," Proceeding of Seventh International Conference on tools with Artificial Intelligence. pp.242-249, 1995.

[24] Yan, C.K., Venetsanopoulos, A. and Filleray, E. "An expert system for landmarking of cephalograms" Proceedings of the Sixth International Workshop on Expert Systems and Applications, pp. 337–356. 1986.

Appendix A

Definitions, Acronyms and Abbreviations

1. **Orthodontics** - branch of dentistry which specializes in the diagnosis, prevention and treatment of problems in the alignment of teeth and jaws.

2. **Cephalometric Landmarks** - One of the points located on oriented-head radiographs from which lines, planes, and angles may be constructed to analyze the configuration and relationship of elements of the craniofacial skeleton.

3. **Craniofacial** - Craniofacial (cranio- combining form meaning head or skull + -facial combining form referring to the facial structures grossly) may be used to describe certain congenital malformations, injuries, surgeons who subspecialize in this area, multi-disciplinary medical-surgical teams

4. **Cephalogram** - special standardized X-ray picture that can be used to measure alterations in the growth of skull bones.

5. **Radiographic** - An image produced on a radiosensitive surface, such as a photographic film, by radiation other than visible light, especially by x-rays passed through an object or by photographing a fluoroscopic image.

6. **Malocclusions** – Misalignments of tooth and jaws

7. **Overbite**, sometimes called **"buck teeth"** — where the upper front teeth lie too far forward (stick out) over the lower teeth

8. **Overbite**, sometimes called **"buck teeth"** — where the upper front teeth lie too far forward (stick out) over the lower teeth

9. **Overbite**, sometimes called **"buck teeth"** — where the upper front teeth lie too far forward (stick out) over the lower teeth

10. **Overbite**, sometimes called **"buck teeth"** — where the upper front teeth lie too far forward (stick out) over the lower teeth

11. **Underbite** — a "bulldog" appearance where the lower teeth are too far forward or the upper teeth too far back

12. **Crossbite** — when the upper teeth do not come down slightly in front of the lower teeth when biting together normally

13. **Openbite** — space between the biting surfaces of the front and/or side teeth when the back teeth bite together

14. **Misplaced midline** — when the center of your upper front teeth does not line up with the center of your lower front teeth

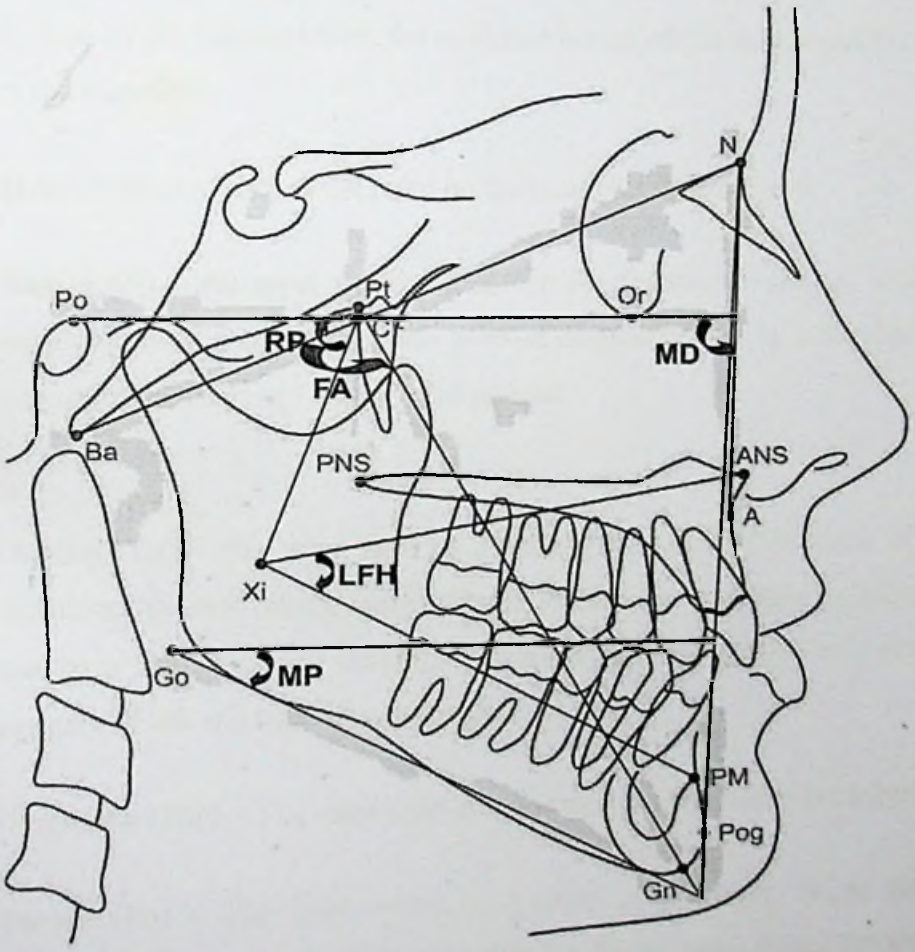
15. **Spacing** — gaps, or spaces, between the teeth as a result of missing teeth or teeth that do not "fill up" the mouth

16. **Crowding** — when there are too many teeth for the dental ridge to accommodate

Appendix B

Commonly used cephalometric points and reference lines

The points and reference lines are shown bellow;



A point (A) – This is the point of deepest concavity on the anterior profile of the maxilla. It is also called subspinale. This point is taken to represent the anterior limit of the maxilla and is often tricky to locate accurately. However tracing the outline of the root of the upper central incisor first and shilelding all extraneous light often aids identification. The A point is located on alveolar bone and is liable to changes in position with tooth movement and growth.

Anterior nasal spine (ANS) – This is the tip of the anterior process of the maxilla and is situated at the lower merging of the nasal aperture.

B point (B) - The point of deepest concavity on the anterior surface of the mandibular symphysis. The B point is also sited on alveolar bone and can alter with tooth movement and growth.

Gonion (Go) – The most posterior inferior point on the angle of the symphysis. This point can be "guesstimated" or determined more accurately bisecting the angle formed by the tangents from the posterior border of the ramus and the inferior border of the mandible.

Menton (Me) – The lowest point on the mandibular symphysis.

Nasion (N) – the most anterior point on the frontonasal suture. When difficulty is experienced locating Nasion, the point of deepest concavity at the intersection of the frontal and nasal bones can be used instead.

Orbital (Or) – the most inferior anterior point on the merging of the orbit. By definition, the left orbital margin should be use so to locate this point. However this can be a little tricky to determine radiographically, and so an average of the two imagers of left and right is usually taken.

Pogonion (Pog) – The most anterior point on the mandibular symphysis

Porion (Po) – The upper most outer most point on the borny external auditory meatus. This land-mark can be obscured by the ear posts of the cephalostat and some advocate tracing these instead. However this is not recommended as they do not approximate to the position of the external meatus. The upper most surface of the condylar head is at the same level and this can be use as a guide where difficulty is experienced in determining porion.

Posterior nasal spine (PNS) – This is the tip of the Posterior nasal spine of the maxilla. This point is often obscured by the developing third molars, but lies directly below the pterygomaxillary fissure.

Sella (S) – The midpoint of the sella turcica.

SN line – This line connecting the midpoint of sella turcica with nasion, is taken to represent the cranial base.

Frankfort plane – This is the line joining porion and orbitale. This plane is difocult to define accurately because of the problems inherent in determining orbitale and porion.

Mandibular plane – The line joining gonion and menton. This is only one of several definitions of the mandibulat plane, but is probably the most widely used.

Maxillary plane – The line joining anterior nasal spine with posterior nasal spine. Where it is difficult to determine ANS and PNS accurately, a line parallel to the nasal floor can be use instead.

Functional occlusal plane – A line drawn between the cusp tips of the permanent molars and premolars (or deciduous molars in mixed dentition). It can be difficult to desidde where to draw this line, particularly if there is an increase curve of Spee, or only the first permanent molars are in occlusion during the transition from mixed to permanent dentition. The functional plane can change orientation with growth and/or treatment, and so is not particularly reliable for longitudinal comparisons.