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Brief Communication

MoirAI System®: An Artificial Intelligence Analysis to predict the Fetal Weight Progression

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Abstract

Artificial intelligence (AI) has revolutionized obstetrics care by leveraging neural networks to analyze extensive patient data for improved diagnosis, monitoring, and prognosis and provide individualized patient care. The MoirAI System® utilizes population data, patient measurements, and AI algorithms to make accurate predictions, focusing on prenatal gestational weight as an illustrative example. The system enhances traditional decision-making by unlocking the potential of complex, interconnected obstetric data, enabling early inference and patient-driven changes. Continuous monitoring and predictions based on historical data improve sensitivity and specificity, thereby enhancing clinical judgment. The study evaluates the system's accuracy through Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), indicating promising results. Further validation and adaptation of AI models are necessary to achieve broader applicability and better predictive accuracy. This study underscores the potential of AI to enhance pregnancy care and calls for continuous development and validation of AI predictive models.

Keywords: Artificial Intelligence, Mobile Application, Prenatal Care, Fetal Weight, Obstetrics

1. Introduction

Artificial intelligence (AI) is the simulation of human intelligence processes by digital computer systems with neural networks to process information [1]. AI has become increasingly prevalent across many fields of medicine, including obstetrics and gynecology. In recent years, artificial intelligence (AI) has gained significant traction in various domains of medicine, including the specialised professions of obstetrics and gynaecology. The exponential growth of breakthroughs in artificial neural networks (ANNs) has facilitated the interpretation of vast and complex datasets through the utilisation of mathematical frameworks [2]. These unique abilities of AI have benefited extensively in the medical field for analyzing vast amounts of discrete or continuous data to assist in patients' diagnosis, monitoring, prognosis, and even disease prevention [3]. AI applications in the field of obstetrics encompass several technologies such as computer-aided foetal evaluators (CAFEs), cardiotocography (CTG), foetal movement analysis, a heart rate monitoring system, and predictive models for premature labour [1,2,4]. The integration of artificial intelligence (AI) techniques holds promise for enhancing patient outcomes and mitigating healthcare expenses through heightened diagnostic and treatment precision, as well as improved operational efficiency.

In the day-to-day obstetrics practice, a wide range of data pertaining to the mother and foetus is routinely generated by various clinical, ultrasonographic, and laboratory investigations to ensure the health and well-being of both mother and fetus.

Therefore, the incorporation of artificial intelligence (AI) as supplementary tools in conventional decision-making processes becomes imperative to fully leverage the vast, intricate, dynamic, and interconnected obstetrics data and achieve optimal outcomes. The existing data has the potential to forecast future advancement, thereby enabling proactive interventions by patients prior to their occurrence. The current data can be used to predict future progression, and thus, early inference may stimulate patient-driven changes before they occur.

In this paper, we present an analysis of the patented MoirAI system® developed by Moirai Tech Sdn. Bhd. Malaysia 202201017381 (1463078-U). We provide a comprehensive overview of the system's functionality, followed by a case study that demonstrates its application in accordance with the SCARE criteria. Additionally, we discuss the assessment process employed to assess the effectiveness and performance of this system [5]. This mobile app is developed to collect, calculate, and analyse existing maternal and foetal parameters with the aim of predicting the progression and outcome of the pregnancy.

2. System Description

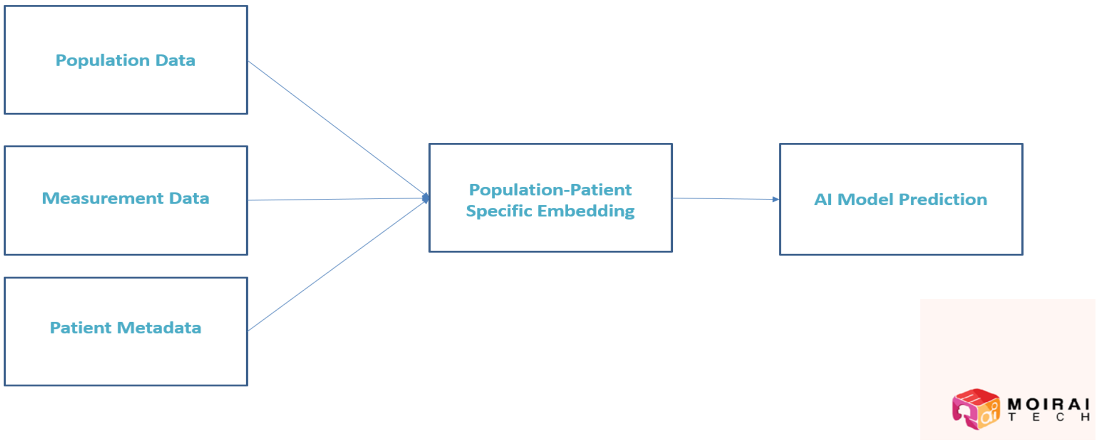

Figure 1: MoirAI System® Summary

The MoirAI system® utilises demographic data, patient measurement data, and patient data in order to generate the most precise prediction trajectory feasible. In this study, the formula is utilised for the assessment of prenatal gestational weight.

A possible way of projecting is by obtaining the z-score for the measurement. Given a gestational age t and a patient's measurement value (e.g. Crown-Rump Length) x_t, existing research (?) already provides an understanding (Fig 1) of the expected distribution E_t that x_t is supposed to follow. We then project x_t onto E_t based on the distribution parameters. We call these features *population-aware* features. A possible way of projecting is by obtaining the z-score for the measurement.

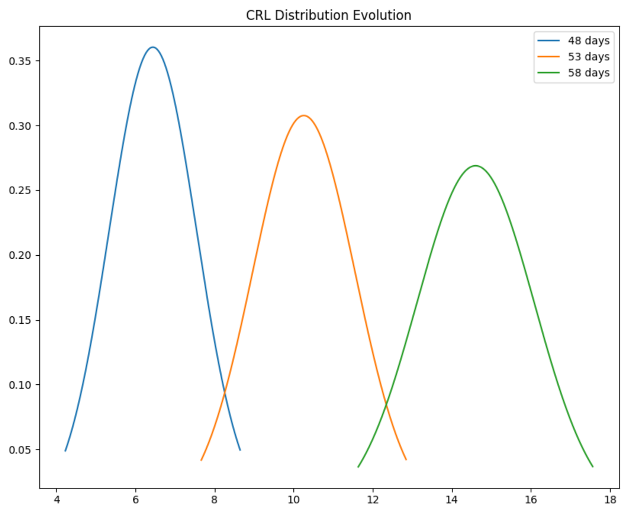

Figure 2: Crown-Rump Length Distribution Evolution

Given the mean μ_t and variance σ_t as the distribution parameters at a time t, we obtain the z-score as follows:

$$z_t = \frac{x_t - \mu_t}{\sigma_t} \qquad [6]$$

Subsequently, we carry out time-series analysis based on these *population-aware* features. One such possible analysis on whether the measurement is stationary can be done via the Augmented Dickey-Fuller Test (ADF).

If the null hypothesis is rejected (the time-series z_t is non-stationary), the measurement x_t likely exhibits abnormal behavior, and the user can be alerted immediately.

3. Presentation of Case

A case of 25-year-old, gravida 7, para 4+2, 1 previous caeserean for term breech presentation, and 3 full-term spontaneous vaginal deliveries with birth weights ranging from 3.2 to 3.4kg (2 girls and 1 boy). She has no other significant medical history. The screening of connective tissue, including antiphospholipid syndrome (APLS), yielded negative results, while the thyroid profile and pap smear conducted in 2020 were within normal limits.

She was diagnosed with a threatened miscarriage at 8 weeks of gestation. Initial early scan showed a dichorionic diamniotic twin with two crump rump lengths (CRL), which correspond to gestation with two fetal heart beats noted. Intramuscular (IM) Hydroxyprogestogen, oral medroxyprogestogen (10mg bd) and folic acid (5mg/day) were started. Unfortunately, her first twin was demised two weeks later. An oral Cardiprin (100mg ON) was added due to her bad obstetric history.

Her routine antenatal blood was normal. She had a nuchal translucency (NT) scan in the first trimester with a 1.3 mm thickness. Her triple test screening in the second trimester was low-risk for trisomy 21, 13 and 18. She also had a detailed scan, and the fetus had an isolated cleft lip with normal other structures. During these periods, the DPT vaccine was given to her.

Due to her high-risk obstetric history, the Moirai Momcare medical AI app with the build-in MoirAI system® was introduced to her to assist and monitor the progression of her fetus throughout the whole pregnancy journey.

At 27 weeks, she was diagnosed with gestational diabetes mellitus. The fetal growth data from ultrasound was computed into the MoirAI system®, and auto-notification was given to the patient and obstetrician that the current estimated fetal weight (EFW) gain of 746g was slower than the fetus's normal growth trajectory with a future possible EFW of 876g at 29 weeks. An AI analysis report by MoirAI System® highlighted that the baby's weight was abnormally low and ran a 59% risk of fetal growth restriction. Clinically, a diagnosis of small for gestational age was made at this point.

She had multiple follow up visits to monitor fetal wellbeing at 29 weeks, 30 weeks, 31 weeks, and 32 weeks (shown in the table below). In each visit, MoirAI System® predicted future EFW with AI analysis and continued tp report that baby weight was abnormally low. Fetal growth restriction was diagnosed at 30 weeks.

At 32 weeks, fetal parameters were at 29 weeks, EFW 1.2kg, AFI 6cm, high umbilical doppler signal, and a relative increase in cardio-thoracic ratio. AI predicted fetal weight of 1174g.

She was transferred to a government hospital for further fetal surveillance and neonatal intensive care unit (NICU) backup. She delivered a baby boy via emergency caesarean section on day 3 of admission due to fetal distress. Baby APGAR score was 9 in 5 minutes and 10 in 10 minutes, required no intubation, and had a birth weight of 1.1kg. The baby assessment was normal with isolated cleft lips. He had a NICU stay for 49 days, and an incubator stay for 37 days. The baby was transferred to the observation room when his weight reached 1.68kg. Currently, she is waiting for further weight gain to be discharged home.

4. System Evaluation

Table 1 presents the antenatal data comparison between the anticipated foetal weight using the MoirAI system® and the ultrasound estimated foetal weight, spanning from 15 weeks to 32 weeks. (Table 1) Each following prediction incorporated all the preceding data up to the moment of forecasting.

Gestational Age (weeks)	BPD/cm		HC/cm		AC/cm		FL/cm		EFW/g	
	Predicted	Ultrasound	Predicted	Ultrasound	Predicted	Ultrasound	Predicted	Ultrasound	Predicted	Ultrasound
15	-	3.02	-	11.63	-	9.09	-	1.63	-	115
19	-	4.18	-	15.04	-	12.59	-	2.04	-	241
23	6.17	5.30	19.28	19.11	17.67	17.39	3.38	3.50	615	455
27	6.02	6.14	21.84	22.71	21.31	20.46	4.42	4.41	739	746
29	6.84	6.90	24.12	25.31	22.93	21.52	5.26	4.94	876	974
30	7.25	6.84	25.51	24.53	23.22	21.52	5.63	5.25	1011	1038
31	7.32	7.49	25.74	26.16	23.32	22.01	5.94	5.37	1095	1176
32	7.62	6.96	26.28	25.75	23.38	22.86	6.10	5.46	1174	1222

Table 1: Comparison Between Ultrasound Data and MoirAI® Predicted Data.

Previous study on the usage of pregnancy data in predicting fetal health status showed considerable accuracy ranging from 88% to 99%. [7] The methodology employed in our model for predicting accuracy differs from that utilised in a previously published study. Based on the data gathered, evaluation for this prediction model was calculated. The Root Mean Squared Error (RMSE) and the Mean Absolute Percentage Error (MAPE) are reported for each of the following measurements (Table 2).

	BPD	HC	AC	FL	EFW
RMSE	5.03	8.04	11.31	4.06	86.5
MAPE (%)	6.2	2.8	4.7	6.6	9.9

Table 2: RMSE & MAPE Between Ultrasound and Predicted MoirAI® System.

It is difficult to assess the effectiveness of these trajectories solely based on these metrics, as there is no obvious benchmark. Furthermore, this is from one case, and we make no claim that the RMSE results (Table 2) can be generalized across a large dataset.

Instead, we claim that the trajectories from MoirAI® were close enough to reality that they would be able to correctly impact decision-making in real-time. The predicted EFW from MoirAI® is very less than 200 – 300g plus minus clinical margin error compared to ultrasound EFW, will increase the sensitivity and specificity of clinical judgement, and minimize error.

5. Discussion

Current healthcare providers face barriers in consultation time, a high volume of patients, diverse demographic characteristics, social-cultural issues, and limited resources [8,9]. The quality of care may be hindered by many issues, since there are instances where obstetrics data is not adequately addressed. Migration from old physical approaches to digitization and automation has the potential to enhance the quality of treatment and decision-making processes in prenatal care, while also addressing existing constraints [10]. This becomes the main foundation of our apps.

The MoirAI® AI system employs foetal ultrasound biometrics to generate predicted values for a duration of up to 40 weeks. The subsequent fetal data serves as checkpoints to assess the accuracy of these predictions and guide the system in forecasting future values. Through this iterative mechanism, the system's accuracy and predictive horizon can be determined.

The introduction of the MoirAI system® in our case played a crucial role in monitoring and managing this high-risk pregnancy. The AI application provided real-time analysis of data pertaining to foetal growth and produced estimations of foetal weight (EFW), hence enabling the timely identification of foetal growth restriction. The prompt identification of the situation resulted in immediate therapeutic treatments, which involved transferring the patient to suitable facilities equipped with advanced neonatal care.

The majority of current foetal weight forecasts rely solely on single-point foetal biometrics to estimate weight at a specific point in time. The uniqueness of our technology is in its utilisation of previously accessible data to enhance the meaningfulness of the existing pool of data and mitigate data gaps. Through the integration of artificial intelligence (AI), patients can gain access to information regarding both the present estimated foetal weight and the anticipated future foetal weight. Hence, this will add value to patients' understanding of fetal growth through an integral analysis of current prenatal care data. We showed that current pregnancy apps should move into analysis through neural networks rather than sole record purposes.

In our case study, the system's performance was evaluated for a high-risk obstetric patient. Albeit it is essential to note that these results are based on a single case, and generalizability to a larger dataset should be approached with caution, it is evident that the MoirAI® predictions were close enough to reality to impact clinical decision-making. The current pilot study is under way to assess the performance of both low-risk and high-risk groups.

One limitation of the study is the absence of a benchmark for assessing the accuracy of the predictions. Nevertheless, the strong correlation shown between the predictions generated by MoirAI® and the ultrasound data, together with the negligible margin of error in clinical settings, implies that integrating this system into the obstetrician's repertoire could prove quite advantageous.

As no single system could cater to all, regional validation is required. This is vital to determining the sensitivity and specificity of an application so that an adjustment can be made to be tailored based on specific population cohorts.

6. Conclusion

The MoirAI system® demonstrates its potential as an effective AI tool in obstetrics, offering real-time monitoring and predictive capabilities that can significantly impact clinical decision-making. The integration of AI applications like MoirAI® into obstetric practice may contribute to more proactive and personalized care for expectant mothers, particularly those with high-risk pregnancies. This study underscores the potential of AI to enhance pregnancy care and calls for continuous development and validation of AI predictive models.

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Authorship Confirmation

Yek Song Quek: conceptualization, methodology, data curation, writing original draft, figure and tables.
Pang Eng Meng Wyzley: conceptualization, methodology, software, AI analysis.
Fathi Ramly: resource, writing review & editing, figure & tables
Bin Shen Chai: data curation, figure, and tables.
Sherlyn Low Si Tong: writing original draft, figure, and tables.
Jamiyah Hassan: resources, writing review and editing, supervision.

Conflict of Interest

Yek Song Quek, Pang Eng Meng Wyzley and Sherlyn Low Si Tong are team developers of the MoiRaI system, while Fathi Ramly and Jamiyah Hassan are independent evaluators of the apps. All authors receive no financial grant or compensation for writing this study.

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None

References

1. Iftikhar, P., Kuijpers, M. V., Khayyat, A., Iftikhar, A., & De Sa, M. D. (2020). Artificial intelligence: a new paradigm in obstetrics and gynecology research and clinical practice. *Cureus, 12*(2).
2. Desai, G. S. (2018). Artificial intelligence: the future of obstetrics and gynecology. *The Journal of Obstetrics and Gynecology of India, 68*(4), 326-327.
3. Beam, A. L., & Kohane, I. S. (2018). Big data and machine learning in health care. *Jama, 319*(13), 1317-1318.
4. Cecula, P. (2020). Artificial intelligence: The current state of affairs for AI in pregnancy and labour. *Journal of Gynecology Obstetrics and Human Reproduction, 50*(7), 102048-102048.
5. Agha, R. A., Borrelli, M. R., Farwana, R., Koshy, K., Fowler, A. J., Orgill, D. P., ... & Kasi, V. (2018). The SCARE 2018 statement: updating consensus Surgical CAse REport (SCARE) guidelines. *International Journal of Surgery, 60*, 132-136.
6. z- z-score. (2008). In W. Kirch (Ed.), *Encyclopedia of public health* (p. 1484). Springer Netherlands.
7. Akbulut, A., Ertugrul, E., & Topcu, V. (2018). Fetal health status prediction based on maternal clinical history using machine learning techniques. *Computer methods and programs in biomedicine, 163*, 87-100.
8. van Engen, V., Bonfrer, I., Ahaus, K., & Buljac-Samardzic, M. (2023). Identifying consensus on activities that underpin value-based healthcare in outpatient specialty consultations, among clinicians. *Patient Education and Counseling, 109*, 107642.
9. Ali, S. A., Dero, A. A., Ali, S. A., & Ali, G. B. (2018). Factors affecting the utilization of antenatal care among pregnant women: a literature review. *J Preg Neonatal Med, 2*(2).
10. Ghimire, S., Martinez, S., Hartvigsen, G., & Gerdes, M. (2023). Virtual prenatal care: A systematic review of pregnant women's and healthcare professionals' experiences, needs, and preferences for quality care. *International journal of medical informatics, 170*, 104964.