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The Problem of Determinism in Machine Learning: Ash'arite and Mu'tazilite Free Will Perspectives

Fauziah Hanum Siregar*
Universitas Islam Negeri Sumatera Utara, Deli Serdang, Indonesia, 20371
Email: fauziahhanum987@gmail.com

Indra Harahap
Universitas Islam Negeri Sumatera Utara, Deli Serdang, Indonesia, 20371
Email: indrahrp@uinsu.ac.id

Sholahuddin Ashani
Universitas Islam Negeri Sumatera Utara, Deli Serdang, Indonesia, 20371
Email: sholahuddinashani@uinsu.ac.id

Hashim Mohammed Adam Hasabalh
Omdurman Islamic University, Omdurman, Sudan, 14415
Email: abudanythashimmhd@gmail.com

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Abstract
The problem of determinism in machine learning is becoming increasingly relevant as predictive analytics, recommendation systems, and algorithmic profiling model human behavior as predictable statistical patterns. Modern studies of the philosophy of technology generally address this issue within the framework of secular rationalism. At the same time, the contribution of classical Islamic theology to the critique of digital determinism remains limited. This study aims to analyze the problem of algorithmic determinism by reconstructing the Ash'arite and Mu'tazilite concepts of free will and to assess their relevance as a critical framework for the metaphysical assumptions of machine learning. This research is a literature study with a philosophical-theological approach, grounded in a hermeneutic reading of primary *kalām* texts and a conceptual-critical analysis of contemporary machine learning literature. The results show that determinism in machine learning is both operational and epistemic, as algorithmic predictions rely on probabilistic correlations rather than final causality in human actions. The Ash'arite perspective, through the concept of *kasb*, shows limited compatibility with digital predictive systems by distinguishing between the creation of actions and the subject's moral responsibility. In contrast, the Mu'tazilite affirmed human rational autonomy and the causal efficacy of actions, thereby demonstrating the limitations of algorithmic deterministic claims in explaining ethical freedom. A comparison of the two suggests that machine learning does not eliminate free will but only enhances the capacity to predict behavior. This research confirms that classical *kalām* can serve as a critical framework for evaluating the metaphysical assumptions of contemporary digital technology.

Keywords: Algorithmic Determinism; Machine Learning; *Kasb*; Free Will; Islamic Theology

Corresponding author: fauziahhanum987@gmail.com*
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Abstrak

Problem determinisme dalam *machine learning* semakin relevan seiring penggunaan *predictive analytics*, *recommendation systems*, dan profiling algoritmik yang memodelkan perilaku manusia sebagai pola statistik yang dapat diprediksi. Kajian filsafat teknologi modern umumnya membahas persoalan ini dalam kerangka rasionalisme sekuler, sementara kontribusi teologi Islam klasik terhadap kritik determinisme digital masih terbatas. Penelitian ini bertujuan menganalisis problem determinisme algoritmik melalui rekonstruksi konsep kehendak bebas Ash'ariyah dan Mu'tazilah serta menilai relevansinya sebagai kerangka kritis terhadap asumsi metafisik *machine learning*. Penelitian ini merupakan studi kepustakaan dengan pendekatan filosofis-teologis melalui pembacaan hermeneutik terhadap teks-teks utama *kalām* dan analisis konseptual-kritis atas literatur kontemporer *machine learning*. Hasil penelitian menunjukkan bahwa determinisme dalam *machine learning* bersifat operasional dan epistemik karena prediksi algoritmik bekerja melalui korelasi probabilistik tanpa kausalitas final atas tindakan manusia. Perspektif Ash'ariyah melalui konsep *kasb* memperlihatkan kompatibilitas terbatas dengan sistem prediktif digital dengan membedakan penciptaan tindakan dan tanggung jawab moral subjek. Sebaliknya, Mu'tazilah menegaskan otonomi rasional manusia dan kausalitas perbuatan sehingga memperlihatkan keterbatasan klaim deterministik algoritma dalam menjelaskan kebebasan etis. Perbandingan keduanya menunjukkan *machine learning* tidak meniadakan kehendak bebas, melainkan hanya meningkatkan kapasitas prediksi perilaku. Penelitian ini menegaskan bahwa *kalām* klasik dapat berfungsi sebagai kerangka kritis dalam mengevaluasi asumsi metafisik teknologi digital kontemporer.

Kata Kunci: Determinisme Algoritmik; *Machine Learning*; *Kasb*; Kehendak Bebas; Teologi Islam

Introduction

The development of machine learning, the core of modern artificial intelligence, has transformed the way humans produce knowledge, predict behavior, and make social decisions. These systems operate through large-scale data processing, mathematical optimization, and probabilistic inference, enabling algorithms to recognize patterns and statistically predict human actions (Farooqi et al., 2024). This characteristic gives rise to the problem of algorithmic determinism, namely the tendency to understand human behavior as something that can be mapped, predicted, and directed through computational models (Adela & Bangsawan, 2026). Algorithmic determinism differs from classical determinism because it relies not on linear cause-and-effect relationships, but rather on probability, data correlation, and statistical pattern-based behavioral predictions (Hair et al., 2025). However, the widespread use of algorithmic predictions can lead to epistemic determinism when machine learning outputs are treated as objective representations of reality and the final basis for decision-making (Holm, 2023). This situation raises philosophical questions about the status of human free will: are human actions still understood as autonomous moral choices or rather as the result of predetermined data calculations?

The urgency of this issue is evident in the use of machine-learning-based predictive systems in strategic sectors that govern social access and individual

rights. A UNESCO report (2024) indicates that more than 60 countries have integrated artificial intelligence into public services, security, education, and the digital economy, while the OECD (2021) notes a significant increase in the use of AI for credit scoring, workforce recruitment, content moderation, and criminal risk analysis. This use often results in systemic bias and the reinforcement of social inequality, as it assumes that algorithmic predictions are neutral and objective. The COMPAS case in the United States, for example, demonstrated racial bias in predictive policing, as the algorithm tended to categorize certain groups as high risk based on historical data patterns (Engels, Linhardt, & Schubert, 2025). Amazon's AI-based recruitment system was also suspended for discriminating against female applicants due to bias in the training dataset (Z. Chen, 2023).

The above phenomena demonstrate that machine learning shapes reality through classification, recommendations, and restrictions on human choice. UNESCO (2024) asserts that reducing humans to a set of data variables can diminish individual dignity and moral agency, while the OECD (2021) highlights the dangers of algorithmic opacity when opaque systems make important decisions. This situation demonstrates the limitations of approaches to technology ethics that focus solely on technical aspects such as fairness, transparency, and accountability without addressing ontological issues regarding the nature of human action. The need for a normative framework capable of explaining the relationship between technological causality, free will, and moral responsibility is becoming increasingly urgent, particularly through an Islamic theological approach, which has a long tradition of discussing will, causality, and human agency.

The study of algorithmic determinism and free will has been extensively explored in the philosophy of technology and the ethics of artificial intelligence, but remains conceptually limited. Hair et al. (2025) explain that machine learning represents a form of statistical determinism based on probabilistic correlations. However, this study is limited to a technological analysis and does not address the metaphysical implications for human agency. Sahakyan, Gevorgyan, and Malkjyan (2025) develop the concept of algorithmic governance and demonstrate that predictive systems shape human behavior through digital nudging mechanisms. However, this research fails to explain the normative basis for the moral responsibility of individuals influenced by algorithms. Salatino et al. (2025) propose the concept of shared responsibility between humans and machines to explain the distribution of ethical responsibility in autonomous systems. However, their study remains within a secular ethical framework that positions humans and technology solely as rational actors.

Duffy (2020) emphasizes the performative nature of algorithmic determinism, as predictions tend to create the social reality they predict. However, this research fails to link this issue to the concepts of free will and religious morality. List (2025) examines the problem of machine learning through the perspectives of Western

compatibilism and incompatibilism to assess the possibility of human freedom within a closed causal system. However, his discussion is limited to the modern Western philosophical tradition. Contemporary Islamic studies on the ethics of artificial intelligence also tend to focus on general principles such as justice, privacy, and welfare, without elaborating on the problem of algorithmic determinism through classical Islamic free-will theory. In fact, the Ash'arite and Mu'tazilite debates regarding the relationship between God's will, *kasb*, causality, and human responsibility provide a relevant conceptual framework for addressing the problem of agency in machine learning. The lack of systematic integration of these theological debates into the analysis of machine learning determinism indicates a research gap. It opens space for developing alternative perspectives in the ethics of artificial intelligence.

The research questions to be examined are: how the structure of algorithmic determinism in machine learning can be understood through the perspectives of Ash'arite and Mu'tazilite free will, how these two schools position the relationship between prediction, causality, and human action, and to what extent the concepts of *kasb* and moral freedom can be used as a normative framework to critique the use of artificial intelligence-based predictive systems. The research aims to analyze the epistemic determinism of machine learning, reconstruct the Ash'arite and Mu'tazilite concepts of free will in the context of modern technology, and map their ethical implications for the problem of human agency and moral responsibility. The research's basic argument rests on the assumption that machine learning is not an epistemologically neutral instrument, since predictive systems always entail implicit claims about the regularity of human action.

The Ash'arite perspective is used to critique the absolutization of technological causality through the concept of *kasb*, which rejects the complete independence of empirical causes. The Mu'tazilite perspective is used to defend human moral autonomy as a condition for ethical justice and accountability for actions. The integration of these two perspectives enables a critical reading of machine learning as a limited epistemic instrument rather than a final authority determining human action. The theoretical contribution of this research lies in fostering a dialogue among Islamic theology, the philosophy of technology, and the ethics of artificial intelligence by reinterpreting the classical concept of free will in the context of modern algorithmic determinism. The practical contribution of this research is to advance human agency-based AI ethics, provide a normative critique of the absolutization of algorithmic decisions, and offer an alternative conceptual framework for developing technology policies that better respect human freedom and dignity.

Method

This study uses a qualitative method grounded in philosophical hermeneutics, drawing on comparative theology and the philosophy of technology, and employs a

cross-disciplinary comparative-critical analysis to examine the relationship between machine-learning determinism and the concept of free will in Islamic theology. Primary data consists of representative works on Ash'arite and Mu'tazilite theology of *kasb*, causality, and human agency, especially the works of al-Ghazālī and 'Abd al-Jabbār, as well as contemporary literature on supervised learning, neural networks, and probabilistic modeling in machine learning. Secondary data include articles on the philosophy of AI, the ethics of technology, and computational determinism, all of which are to the problem of algorithmic agency. Data collection was carried out through a systematic literature review using a purposive sampling technique based on conceptual keywords, academic authority criteria, thematic relevance, and the periodization of the literature. Data analysis was carried out through four stages, namely conceptual reconstruction to standardize terminology across traditions, contextual interpretation of the internal development of classical theology, analogical mapping based on comparative epistemology with limitations on ontological and epistemological levels, and critical synthesis to formulate a framework for the Islamic philosophy of artificial intelligence in understanding algorithmic determinism in a reflective and non-reductionistic manner.

Results and Discussion

Deterministic Structure in Machine Learning

Machine learning determinism cannot be understood as a single, simple, mechanistic principle because the structure that determines algorithmic output comprises hierarchical relationships among computational laws, statistical distributions, and the system's implementation configuration (Uddin & Lu, 2024). Mathematical determinism operates through formal functions that relate inputs to outputs according to defined transformation rules, but this formal consistency is not synonymous with practical readability. Differential operations, activation function composition, and gradient propagation follow fixed computational laws, even though model behavior often appears unintuitive due to the complexity of the non-convex parameter space (Gisin, 2021). Probabilistic determinism is also not reducible to pure uncertainty because probability distributions remain subject to measurable statistical regularities. Probability serves as a mechanism for regulating the likelihood of output, not a denial of algorithmic causality (Cox, 2021). Meanwhile, operational determinism refers to systemic reproducibility influenced by hardware synchronization, floating-point arithmetic, computational pipelines, and parallel execution mechanisms (Hermens, 2019). These three forms constitute a layered deterministic structure, demonstrating that machine learning operates through computational causal closure rather than through autonomous freedom, as in human agency.

The algorithmic causality of supervised learning demonstrates that the learning process occurs through a co-determinative relationship among the data distribution, the hypothesis function, the objective function, and the error evaluation

mechanisms. Training data does not act as a single cause directly generating a specific prediction, but rather constrains the space of possible representations that the model can learn (Lourenço et al., 2025). Labels serve as mathematical normative constraints that guide optimization toward specific parameter configurations via loss minimization (Lienen & Hüllermeier, 2021). This structure demonstrates that machine learning causality is relational and distributed rather than linear and mechanistic, as in classical causal models. Hidden layers of neural networks form internal representations that humans cannot intuitively reconstruct, but this epistemic opacity does not negate the existence of formal causal relationships (Boge, 2022). The black-box problem is better understood as a limitation of human interpretability of the model's representational processes, rather than as evidence of the ontological indeterminacy of algorithmic systems. This distinction is important because many critics of AI mistakenly equate the human inability to read computational trajectories with the absence of deterministic structures.

The training process enforces determinism through an iterative optimization mechanism that drives parameters toward a specific objective function. The loss function serves as an artificial teleological principle, defining the system's success horizon. Each weight update follows a measurable mathematical relationship via gradient propagation, optimization descent, and parameter adjustment based on a pre-established error landscape (Capraru, 2024). However, computational determinism is not synonymous with absolute predictability. Non-convex optimization can lead to numerous local minima and saddle points, and to high sensitivity to parameter initialization. This complexity results in computational irreducibility, making the model's behavior difficult to predict in practice, even though it remains subject to computational causal necessity. The human inability to map all optimization trajectories is better understood as an epistemic limitation of complex, high-dimensional systems, rather than as evidence that machine learning operates without a consistent causal structure.

Model architecture provides a layer of determinism that is often overlooked, as research attention is primarily focused on data and optimization. The choice of network depth, attention mechanism, convolutional structure, regularization scheme, and representation type determines the class of functions a model can learn long before the training process begins. The architecture acts as a structural conditioning mechanism that limits the horizon of possible outputs and shapes the system's representational bias (Conwell et al., 2024). Convolutional neural networks, for example, are designed with specific spatial assumptions, allowing them to capture visual patterns only through local connectivity and weight sharing. The transformer architecture also guides the learning process through an attention mechanism that prioritizes specific token relationships (Choi & Lee, 2023). This structure demonstrates that machine learning determinism is co-constructive between model design and the empirical distribution of data. Data does not operate

in a neutral space, as each form of representation is preconfigured through architectural affordances that determine the likely inference patterns.

Stochastic elements such as stochastic gradient descent, random initialization, mini-batch sampling, and dropout are often understood as evidence of the non-deterministic nature of machine learning. This view simplifies the relationship between stochasticity and computational causality. Algorithmic randomness is generally pseudo-random because it is generated by a defined mathematical procedure that can be reproduced when the seed, hardware configuration, and computing environment are held constant (Tutueva et al., 2021). The stochasticity function is primarily concerned with the efficiency of parameter-space exploration and the avoidance of local-minima traps, not with the creation of metaphysical contingencies. Although distributed deep learning sometimes produces output variations due to asynchronous computation, floating-point inconsistencies, and non-deterministic GPU execution, these variations are constrained by causal relationships that can be formally analyzed. Stochastic learning is better understood as an epistemic strategy for managing system complexity rather than a rejection of ontological determinism (Wang, Yang, Li, & Kan, 2023).

The problem of determinism in machine learning becomes more complex when distinguishing between ontological determinism, epistemic opacity, and probabilistic regularity. Ontological determinism holds that each system state is generated by predetermined computational transition rules (Serrado, 2025). Epistemic opacity arises because humans lack sufficient representational capacity to reconstruct all relationships among high-dimensional parameters (Fazi, 2021). Probabilistic regularity operates as a distributional mechanism that regulates the tendency of model output based on statistical patterns of historical data (Chen, Liu, & Li, 2023). This distinction is important to prevent uncertainty from being arbitrarily reduced to evidence of the ontological freedom of algorithmic systems. The behavioral complexity of modern models can indeed produce unpredictable emergent behavior, but the emergence of emergent properties does not automatically negate computational causal closure. Emergencies are better understood as the result of the interaction of numerous systemic constraints that exceed human observational capacity.

Analysis of machine learning determinism ultimately demonstrates a significant shift from classical mechanistic determinism to probabilistic and systemic structural determinism. Algorithmic output is not determined by simple linear causal relationships, but rather by complex interactions between model architecture, data distribution, objective function, stochastic optimization, and the computational environment. This structure produces computational causal closure without necessitating full epistemic transparency. Machine learning determinism also differs from classical metaphysical determinism in that it operates by regulating possibilities and restricting inference spaces, rather than by absolute certainty

about every future state. This characteristic opens up a critical dialogue with Ash'arite and Mu'tazilite theories of free will. The Ash'arite concept of *kasb* can be read as a parallel to constrained algorithmic agency, which operates within the horizon of structural determination. At the same time, the Mu'tazilite emphasis on the autonomy of action presents a serious tension with historical data-based models of behavioral prediction.

Free Will in Ash'arite and the Problem of Systemic Determination

Ash'arite theology of free will pivots on the doctrine of *kasb*, a compromise formulation that reconciles God's omnipotence with human moral responsibility. *Kasb* positions humans as conscious subjects who acquire God's created actions through the direction of their will and inner intention (Al-Ash'arī, 1955). This formulation arose from the Ash'arite rejection of human causal autonomy, which they saw as potentially undermining the absolutism of monotheism (Wolfson, 1976). However, the concept of *kasb* cannot be understood simply as a harmonious doctrine, as its ontological structure raises epistemological questions about the status of human agency. If all actions are created through God's will at every moment, human will seems to lose its actual causal effectiveness, leaving only its normative function. This tension makes *kasb* more appropriately understood as a form of theological compatibilism that maintains moral accountability through intentional awareness, rather than through the ability to produce independent actions. Such a reading demonstrates that the Ash'arite do not completely reject freedom, but rather redefine it as a reflective awareness of God's created actions.

The Ash'arite tradition articulates the creation of action through an occasionalist structure that rejects the inevitability of secondary causes. Empirical regularity is understood as a divine habit (*'adah*) that occurs according to God's will (Al-Ghazālī, 2000). The rejection of secondary causality has significant epistemological implications: the stability of empirical causal relationships ceases to be necessary and depends entirely on the continuity of God's will. This perspective creates a fundamental difference from the modern scientific paradigm, which bases predictability on empirical regularity. Machine learning, on the other hand, operates through statistical pattern recognition and the assumption of the stability of probabilistic relations between variables (Bernardes, 2024). This tension demonstrates that Ash'arite occasionalism is incompatible with the epistemic foundations of algorithmic determinism. The comparison between the two is relevant because both posit regularity as the result of non-autonomous structures. Ash'arite attributes regularity to God's will, while machine learning attributes it to human-constructed configurations of data and computational parameters.

The relationship between human will and God's will in Ash'arite thought is asymmetrical, as the divine will has a creative and determinative status. In contrast, the human will is only receptive and intentional (Griffel, 2009). This structure raises serious philosophical questions regarding the basis of moral responsibility. If

humans lack ontological effectiveness over actions, the legitimacy of praise and blame requires a basis other than causal control. Ash'arites address this issue by emphasizing inner awareness, intention, and the directionality of human will toward actions (Al-Ghazālī, 1997). This formulation shows a close affinity with modern compatibilism, which holds that moral responsibility is possible even though actions are determined by a network of factors (Bailey, 2022). However, Ash'arite differs from contemporary secular compatibilism because it rests on a theistic metaphysical horizon and the concept of divine command. Conceptual tensions remain because subjective experiences of choice, regret, and inner conflict confront the doctrine of God's total creation of action. *Kasb* ultimately emerges as a theological compromise that maintains the normative function of human consciousness without granting full causal autonomy over actions.

The analogy between the structure of *kasb* and machine learning determinism requires methodological caution to avoid falling into the trap of conceptual reduction. Algorithmic determinism is achieved through mathematical operations that, given parameters, weights, model architecture, and training data, produce probabilistic outputs. The system does not act through conscious will, but rather through statistical optimization of learned patterns (Adela & Bangsawan, 2026). The formal similarity with *kasb* arises only in the absence of independent causal autonomy. Machine learning does not make decisions freely, whereas, according to Ash'arite thought, humans do not ontologically create actions. However, this similarity stops at the structural level and does not address the metaphysical basis of each system. Algorithmic determinism is immanent, impersonal, and dependent on mathematical calculations, while the creation of action in Ash'arite originates from the personal-transcendent will of God. This distinction is crucial because failing to distinguish between the two could lead to equating technical determinism with metaphysical determinism. An overly far-fetched analogy would obscure the ontological distinction between computational systems and religious human agency.

The most fundamental difference between machine learning and the concept of *kasb* lies in the dimensions of consciousness and moral subjectivity. Computational systems process symbolic and numerical representations without phenomenological experience, inner reflection, or normative intentionality. This processing enables pattern recognition and statistical decision-making, but does not produce a conscious experience of choice or responsibility. Contemporary philosophical debates on artificial cognition have indeed opened up discussion, but modern machine learning still lacks the capacity for existential subjectivity that underlies the attribution of will. Ash'arite *kasb*, on the other hand, maintains that human consciousness is the core of moral accountability, even though humans are not the creators of actions. The experience of regret, inner conflict, intention, and ethical considerations form the basis of the moral meaningfulness of human actions. Philosophical problems arise when such consciousness is not accompanied by actual

causal effectiveness. This tension demonstrates that the central problem of *kasb* is not simply the relationship between God and humans, but the possibility of maintaining moral subjectivity within the structure of total metaphysical determination.

The dimension of normativity further clarifies the limits of the analogy between algorithmic determinism and Ash'arite theology. Ash'arite morality is rooted in God's will and realized through human obedience to divine commands (Toosi, 2020). This structure demonstrates a tendency toward theological voluntarism, as the values of good and evil derive their legitimacy from God's authority rather than from independent moral rationality. In contrast, machine learning lacks an internal normative horizon. Ethical judgments about algorithmic output always originate from the designers, regulators, or users who determine the system's goals. This situation makes algorithmic ethics problems closely related to data bias, accountability, transparency, and the distribution of human responsibility for automated decisions. The delegation of decisions to predictive systems often creates the illusion of objectivity, shifting moral responsibility toward technical mechanisms perceived as neutral. The Ash'arite perspective is a critique of the sacralization of algorithms, as moral responsibility remains attached to the conscious subject rather than to the technical instruments humans use. This reading expands the relevance of *kasb* as an evaluative tool in the face of contemporary techno-determinism.

The relationship between algorithmic determinism and Ash'arite theory of free will becomes more complex when machine learning is understood as a form of probabilistic determinism, rather than classical mechanistic determinism. Modern algorithmic systems do not always produce identical outputs, as many models estimate probabilities and learn adaptively from new data. This characteristic distinguishes machine learning from the Ash'arite concept of absolute metaphysical determinism, which holds that all actions are under God's will at all times (Saenong et al., 2024). Algorithmic determinism is limited to a specific technical space and remains dependent on human intervention through model design, data selection, and outcome evaluation (Agudo et al., 2024). Ash'arite does not legitimize the transfer of human responsibility to automated systems. Conversely, a critical reading of *kasb* demonstrates that the limitations of causal control do not automatically eliminate the demands for ethical accountability and moral reflection on human subjects.

Comparative evaluations suggest that the relationship between *kasb* and machine learning determinism is better understood as a critical dialogue between paradigms rather than an attempt at conceptual equivalence. Ash'arites operate within a theistic-metaphysical horizon that positions God's will as the source of existence and morality, whereas machine learning operates through technical rationality grounded in statistical calculations. Similarities in the limitations of

causal autonomy are insufficient to unite the two, as their ontological, epistemological, and normative bases are fundamentally different. This analysis demonstrates that the contemporary problem of free will is no longer solely about metaphysical determination but also about technological determination, which shapes how humans understand decisions, predictions, and responsibilities. Machine learning presents a new form of non-metaphysical determinism that operates through the authority of data and predictive efficiency. This situation demands a rereading of classical free will theories, including Asharite theories, to address the challenges posed by modern technology without falling into the trap of theological apologetics or algorithmic glorification.

Freedom and Autonomy in Mu'tazilite in the Face of Predictive Algorithms

The Mu'tazilite doctrine of human freedom rests on the principle that rational subjects possess effective agential capacity through *qudrah* and *ikhtiyār*, so that moral action arises from self-determination rather than the mere actualization of external causes (Nasution, 2015). This conception is not aimed at limiting God's omnipotence, but rather at maintaining the coherence of the principle of *al-'Adl* (justice) as the rational foundation of Mu'tazilite theology. Praise, blame, reward, and punishment only gain legitimacy if humans are truly the causal source of action (Mutahhari, 1985). This framework positions freedom as agency causation that keeps alternative actions open. This position adopts a modern libertarian view of free will, which rejects reducing human action to the necessary consequences of a series of antecedent causes. God's knowledge is understood to be non-compulsive, so that Divine omniscience does not render human choice a matter of necessity (Caruso, 2025). The distinction between knowing and determining is central because perfect knowledge is not synonymous with ontological coercion of known actions.

Mu'tazilite arguments regarding Divine justice suggest that attributing sin or deviance to humans is only meaningful if humans possess the ability to act before the act is actualized. Al-Qāḍī 'Abd al-Jabbār (1965) posits this ability as a categorical capacity that enables subjects to choose among alternatives on rational grounds. Such freedom is not equated with empirical unpredictability, but rather with rational self-determination that makes humans the normative source of their own actions. Problems arise when modern machine learning identifies regularities in human behavior through predictive analytics, recommendation systems, and behavioral profiling (Bhatt et al., 2023). High predictive accuracy raises the suspicion that human decisions are actually subject to deterministic patterns that algorithms can map. The philosophical tension lies in whether statistical predictability merely reflects the consistency of rational motives or whether hidden causal structures entirely control human choices. The Mu'tazilites need to address these challenges so that the concept of *ikhtiyār* does not remain a normative affirmation detached from contemporary computational realities.

Machine learning-based algorithmic predictions operate by extracting correlative patterns from past behavioral data, while metaphysical determinism presupposes necessary causal relationships that preclude alternative courses of action (Cui & Athey, 2022). This distinction is crucial because the success of an algorithm in projecting behavior does not automatically prove that deterministic laws produce human actions. Statistical correlations only demonstrate empirical regularities, not causal closure of human agency. This position maintains space for *ikhtiyār* because actual choices still emerge through the subject's deliberation when actions are taken. However, reducing algorithmic problems to mere neutral observation is also inadequate. Contemporary machine learning not only describes tendencies but also shapes choice environments through adaptive personalization, filtering, and reinforcement systems that influence user preferences (Gao et al., 2024). Such digital structures create a feedback loop between prediction and action, blurring the line between observation and intervention. The primary challenge is not simply the algorithm's ability to read patterns, but rather its ability to gradually condition rational behavior.

This condition demands a more precise reformulation of the relationship between behavioral probability and ontological freedom. Metaphysical determinism holds that every action is determined by antecedents that cannot be altered (Gisin, 2021), whereas probabilistic prediction assigns probabilities based on empirical regularities (Cox, 2021). However, high probabilities can still produce probabilistic conditioning that limits the scope for actualizing choices through structural pressures, preference repetition, and the formation of digital habits. The Mu'tazilite accepts that human reason often moves according to consistent motives, but consistency is not synonymous with causal inevitability. The ability to deviate from one's inclinations remains central to understanding, as reason can reflectively reevaluate motives for action (Al-Murtaḍā, 1988). Freedom does not depend on the absence of behavioral patterns, but rather on the existence of robust alternative possibilities that allow subjects to act differently even if the previous pattern is predictable. Predictive accuracy only indicates the regularity of rational human tendencies, not the total elimination of the possibility of reflective deviation.

The rational autonomy of the Mu'tazilites cannot be reduced to absolute unpredictability, as free action may still have stable patterns. Freedom rests on deliberative capacity, an understanding of reason, and the normative ability to evaluate actions in light of moral values (Aḥmad, 1965). This perspective is crucial to avoid the fallacy of algorithmic reductionism, which views predictability as evidence of a loss of agency. Although algorithms can reconstruct motivational states through data inference, such access remains extrapolative rather than constitutive of action. Algorithms do not create the subject's internal reasons; rather, they interpret external indicators that correlate with decisions (Sukma & Namahoot, 2025). The problem becomes more complex when digital systems influence the

architecture of choice through personalized recommendations, information ranking, and nudging behavior. Such digital environments can narrow the space for deliberation without eliminating freedom. This situation is better understood as bounded rational autonomy, a condition in which autonomy persists. However, it is constrained by predictive pressures and the structural design of digital platforms that continue to shape user preferences (Han, 2017).

The Mu'tazilite framework becomes particularly relevant when algorithmic predictions serve as the basis for social evaluation before actual actions occur. Predictive policing, credit scoring, and automated risk assessment often shift moral judgment toward behavioral probabilities, rather than concrete actions. This shift is problematic because punitive tendencies blur the distinction between the possibility and the actuality of actions. The Mu'tazilite principle of justice rejects the use of probability as a basis for moral attribution, since responsibility attaches only to deliberately chosen actions (Aḥmad, 1965). This critique targets the epistemic fallacy of treating probabilistic models as definitive representations of human futures. The misuse of prediction reduces personhood to a data object assessed based on statistical risk calculations. This situation threatens the presumption of agency, as humans are positioned as entities that have been "determined" before actual actions occur. The Mu'tazilite critique demonstrates that justice demands recognition of the human capacity to act beyond probabilistic projections.

The tension between human rationality and algorithmic determinism demonstrates the Mu'tazilites' important contribution to contemporary discourse on the philosophy of technology. This tradition offers a model of agency that positions humans as normative subjects, not mere data nodes reducible to statistical patterns. The clear distinction between probabilistic description and metaphysical determination preserves space for moral responsibility while avoiding romanticizing freedom and ignoring the structural influence of digital technology. The reconstruction of the concept of *ikhtiyār* as bounded rational autonomy enables the integration of classical theology, the philosophy of action, and computational prediction without falling into either hard determinism or naive voluntarism. This framework demonstrates that the predictability of behavior does not automatically eliminate freedom but can narrow the conditions for the actualization of autonomy through the engineering of choice environments. The central issue in the machine learning era is not simply whether humans remain free, but rather the extent to which rational subjects can maintain reflective capacity as digital ecosystems continue to direct, shape, and normalize human decisions.

A Comparative Analysis of Algorithmic Determinism and Free Will Theory

A comparative analysis of algorithmic determinism demands a conceptual distinction between the procedural certainty of computational systems and metaphysical claims about human will. Machine learning operates through probabilistic optimization based on data correlation, parameter updates, and

predictive model engineering directed toward specific performative goals (Cao et al., 2024). This characteristic results in operational determinism that is closed at the level of calculation but remains epistemically open because it depends on model design, data structures, institutional goals, and the social configurations that shape the algorithmic environment. This reduction is problematic because high probability is not synonymous with metaphysical inevitability. Recommendation systems, predictive analytics, and automated decision-making can shape collective behavioral patterns. However, this ability remains at the level of behavioral estimation, not absolute determination of human will. Algorithmic relations are better understood as structures of epistemic mediation that shape the horizon of choice without eliminating the reflective capacity of the human subject.

The Ash'arite paradigm offers a relatively flexible interpretative framework for the systemic regularities of machine learning through the concept of *kasb*, which distinguishes between the creation and acquisition of actions. This framework allows for the recognition of algorithmic causal regularities without transforming computational systems into sources of moral autonomy. Algorithmic predictions serve only as mediating instruments that help guide decisions based on statistical patterns. At the same time, the moral legitimacy of actions remains dependent on human intention, rational evaluation, and normative approval. This flexibility makes *kasb* compatible with the reality of machine learning, which operates through probabilistic regularities. This compatibility does not mean that the Ash'arites passively accept the entire structure of digital determination. Instead, *kasb* opens up space to critique the tendency of modern technology to confer epistemic legitimacy on statistical predictions for social control. This perspective rejects the assumption that computational regularities can be treated as moral inevitability. Humans remain situated in the realm of intentional considerations that cannot be reduced to calculative mechanisms, even though empirical behavior can be mapped through large-scale data analysis.

The Ash'arite paradigm faces serious problems when *kasb* is understood too narrowly, bordering on passive fatalism. Machine learning structures shape preferences through personalization systems, digital nudging, ranking algorithms, and the engineering of choice environments that operate in a non-transparent manner (Z. Zhang, 2025). This situation has the potential to foster a misinterpretation that the dominance of algorithmic systems resembles an absolute, unchallengeable order. The primary problem lies not in Ash'arite theology itself, but rather in the epistemic transformation that treats statistical predictions as technological destiny. This risk arises when the authority of computational systems is accepted without critical evaluation, thereby losing the capacity to reflect on digital power structures. *Kasb* needs to be emphasized as an intentional relationship that positions humans as evaluative subjects rather than merely as recipients of mechanistic outcomes. This affirmation is crucial to ensure that Ash'arite

compatibility with operational determinism does not passively legitimize algorithmic bias, behavioral manipulation, or the epistemic dominance of modern digital platforms.

The Mu'tazilite paradigm faces a more complex tension because its foundation of free will positions humans as causal agents with the independent capacity to determine actions (Mutahhari, 1985). Problems arise when machine learning can generate high-probability behavioral predictions from analysis of historical patterns, consumption preferences, and digital interaction records. This predictability gives the impression that human choices merely reproduce statistical patterns that computational systems can anticipate. The Mu'tazilite's primary difficulty lies not simply in defending abstract freedom but in explaining how freedom remains meaningful when empirical behavior can be systematically modeled. This challenge is further complicated by the adaptive nature of machine learning, which operates through reinforcement learning and behavioral optimization, continually updating models based on user responses (Shahid et al., 2022). This situation creates epistemological pressure on classical libertarianism, as empirical unpredictability can no longer be considered a primary indicator of human freedom. Statistical predictability is not synonymous with ontological determinism, but it nonetheless undermines the assumption that human action is entirely spontaneous and unmodelable.

The Mu'tazilite's defense is insufficient if it relies solely on the distinction between knowledge and determination. Machine learning does not stop at reading behavioral patterns; it also shapes the decision-making environment through adaptive recommendations, information filtering, and the optimization of user attention (A. Zhang et al., 2023). This structure narrows the spectrum of actual choices, although it does not eliminate the possibility of formal choice. Human freedom ultimately faces gradual, not coercive, structural pressures. This situation suggests that the primary problem lies in the ongoing formation of preference horizons through algorithmic mediation. The Mu'tazilite requires a conceptual repositioning so that freedom is no longer measured by the unpredictability of empirical behavior, but rather by the reflective capacity to assess, accept, or reject the impulses generated by digital systems. This reinterpretation shifts the focus of freedom toward the rational evaluative capacity that persists even in predictive environments. This repositioning is more relevant to the reality of artificial intelligence, which operates through behavioral conditioning rather than the absolute determination of human will.

A comparative analysis shows that both the Ash'arites and the Mu'tazilites require reformulation when confronting modern algorithmic determinism. The Ash'arites are better able to accommodate the probabilistic regularities of machine learning because the concept of *kasb* initially accepts the connection between human will and external causal structures. However, this compatibility risks

normalizing the dominance of digital systems if human reflective capacity is not firmly established. The Mu'tazilites maintain a broader scope for freedom but struggle to explain how causal autonomy persists when human preferences can be systematically shaped through data infrastructure. The two paradigms ultimately converge on the need to redefine freedom as an evaluative capacity rather than as synonymous with empirical unpredictability. Human freedom is no longer understood as the ability to produce unstructured actions, but rather as the reflective ability to consider moral reasons amidst the predictive pressures of algorithmic systems. This perspective allows for a new synthesis between classical theology and the philosophy of technology without reducing humans to objects of statistical calculation or metaphysical agents completely isolated from digital social structures.

The distinction between operational determinism and ontological determinism is the primary foundation for resolving machine learning's philosophical challenges to free will. Operational determinism refers to the procedural certainty of computing systems that operate through mathematical rules, data processing, and model-optimization mechanisms. Ontological determinism is the metaphysical claim that humans have no real alternatives in their actions. Machine learning falls into the first category, as all predictions remain dependent on constantly changing and reengineered empirical variables. A significant error arises when probabilistic regularities are interpreted as evidence that humans lack ontological freedom. This reduction ignores the fact that algorithms lack normative consciousness or moral intentionality. Computing systems merely map possible behaviors based on historical data and cannot determine the ethical legitimacy of human actions. This distinction allows for a more precise evaluation of the relationship between AI and free will, preventing the debate from becoming mired in the simplification that automated technology eliminates human agency.

Conclusion

The problem of machine learning determinism demonstrates that algorithmic predictions are not identical to metaphysical inevitability but rather reflect operational determinations shaped by data patterns, model optimization, and computational architectures, which can influence human preferences, perceptions, and the direction of decision-making. A comparative analysis shows that the Ash'arite *kasb* theory presents a form of theological compatibilism that positions humans as subjects of volitional acquisition amidst regular causal structures, so that moral agency persists even though predictive systems shape possible actions. Meanwhile, Mu'tazilite rationalism emphasizes the importance of ethical autonomy and individual responsibility as the basis for criticizing the reduction of humans to statistical output, including the practice of behavioral manipulation, digital information asymmetry, and the dominance of technology corporations. The

resulting formulation of critical compatibilism enriches the discourse on Islamic philosophy of technology by integrating classical theology, explainable AI, human oversight, and algorithmic bias mitigation. Limitations are apparent in the conceptual-normative approach, given the lack of empirical testing of user behavior, and in the study's limited focus on Ash'arite and Mu'tazilite. Further research agendas include empirical studies of the influence of recommender systems on Muslim users' autonomy, comparisons with Maturidite, and the development of AI ethics grounded in *maqāṣid al-Sharī'ah* and algorithmic governance.

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Author Contribution Statement

FS contributed to the conceptualization of the study, development of the research design, data analysis, interpretation of the findings, writing the initial draft, substantial revision of the manuscript, and correspondence during the submission and publication process. IH contributed to data collection and verification, literature review, and partial drafting of the manuscript. SA contributed to data analysis, argumentation refinement, and academic editing to ensure consistency and substantive accuracy. HM contributed to the validation of the analysis results, the critical review of the manuscript, and the final revisions before the manuscript was accepted for publication.

Conflict of Interest

The authors declare no conflicts of interest whatsoever in the preparation, execution, analysis, writing, or publication of this manuscript. No financial, professional, institutional, or personal relationships exist that could affect the objectivity, integrity, or interpretation of the results presented in this study. The entire research process and manuscript preparation were conducted independently, guided by academic considerations and applicable scientific ethical standards.

AI Usage Statement

Artificial intelligence (AI) technology was used in the preparation of this manuscript only to a limited extent to assist in improving language quality, grammar correction, editing, and formatting to ensure compliance with writing guidelines. AI was not used to generate the scientific substance of the research. All problem formulation, research objectives, methodological design, data collection and analysis, interpretation of findings, concept development and argumentation, discussion formulation, conclusion drawing, and all results and findings presented in this manuscript are the result of the author's own thoughts, critical review, and the full responsibility of the author.

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